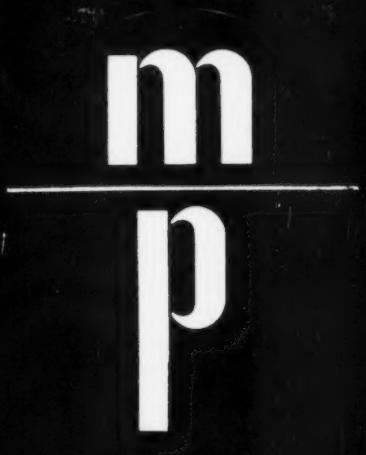
MODERN PLASTICS



FEBRUARY 1950

It pays to use your custom molder's know-how

says well-known maker of recording meters

No. 14 in a series on Plastics Skill at Work...

PRODUCT:
Hays-Penn Flow-Meter Door with adapter-insert
CUSTOMER:
Penn Industrial Instrument Corporation, Philadelphia
MOLDER:
Auburn Button Works, Inc. Auburn, N. Y.
MATERIAL:
General-purpose Durez black phenolic plastic

BASIC DOOR is a 1-piece, 3½-pound Durez molding 16"x 20½" in size, having all holes (40) for assembly of attached parts molded in. The main opening provides a sector for viewing an indicator moving above the circular flow-chart.

CURVED INSERT, a molded piece of Durez weighing only 2⅗ ozs., neatly adapts the large molding to fit the "face" requirement of another model. Substantial savings over tool cost for a whole new door resulted from this ingenious maneuver.

"NEW" DOOR is a simple assembly job, with internal bosses which serve as bases for mounting a fluorescent light, ink bottle holders, and the gasketed glass panel. No surface finishing is required... moldings are ready for immediate assembly.

● There are numerous rewards for taking a skilled firm of custom molders into your confidence. One, illustrated in these two doors for industrial recording instruments, is the way molders help to cut corners in production, in other words, to reduce cost.

Much careful planning had gone into the original door, a rather large molding of Durez plastics with no fewer than forty openings molded in. When a door for a second instrument, with a somewhat smaller "face" was wanted, discussion between design engineers and the molder's technicians evolved a plan to adapt the first door by merely adding an insert that covers the unwanted area. Only a small mold for the insert was required. By increasing output from the original mold, and molding the flat insert piece, the customer obtained a "new" door.

Competent molding know-how was revealed also in the selection of the right Durez phenolic for this job. The properties of the material permit use under conditions that would be harmful to metals and finishes. With Durez no surface finishing is required; a smooth surface is obtained in the molding process. The door has the requisite dimensional stability and it serves as an insulating base for the electrical circuits within.

Let Durez put you in touch with experienced custom molders. At any time you wish, a competent Durez plastics technician will gladly sit in on your planning sessions.

A hit with plastics users everywhere is the handy "Durez Check-Chart." Write for yours. Durez Plastics & Chemicals, Inc., 122 Walck Rd., N. Tonawanda, N. Y.

DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- PROTECTIVE COATING RESINS

PHENOLIC PLASTICS THAT FIT THE JOB

Time...EVER MORE PRECIOUS
WHEN ENCASED IN Catalin
We acknowledge with appreciation a truly sincere compliment! General Electric selects Catalin, cast (not molded), to most fittingly frame its new mid-century timepiece. In a brilliant, richly grained and highly polished walnut, Catalin, the gem of plastics, as unveiled below, reflects the wisdom of General Electric's choice!
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MODERN PLASTICS*

VOLUME 27 FEBRUARY 1950 NUMBER 6

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Better diameter control

YOU can get better results than ever before with Geon plastics in the new cube form.

Because of the uniform, cubical size, heating during extrusion is more even and complete. Porosity which is occasionally caused by entrapped air in non-uniform granules is minimized.

Geon in cube form will improve your processing operations, make production savings for you, too. It's another example of how B. F. Goodrich Chemical Company continually seeks and *finds* ways to give you better products, greater savings.

For further information about Geon plastics in cube form, please write Dept. GA-2, B. F. Goodrich Chemical Company, Rose Bldg., Cleveland 15, Ohio.

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GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers

. . . and it's Chicago Molded Plastics, of course!

• *Not to sell, but to make folks want to buy . . . that was what F. & F. Laboratories, Inc. wanted in their counter display stand for Sherbits . . . the delicious candy bits. And that's what they got in this handsome new low-cost unit injection molded of brillant red and polystyrene with lettering hot stamped in white. It's already ringing up new sales records on candy counters everywhere.*

* * * *

Here's another case (there are hundreds of them) where the use of Chicago Molded Plastics has provided definite advantages over other materials . . . plus a worthwhile reduction in costs.

Sherbits have been sold from various types of display units. But . . . with counter space at a premium and countless products competing for it, just any old display won't get to first base with the alert retailer.

Faced with this problem, F. & F. Laboratories came to Chicago Molded. This colorful, compact, eye-catching display is the result. And it's rapidly putting Sherbits "out front". Dealers like it because it occupies little space. It's light in weight. And no matter how long it's used, the permanent molded color will retain its sparkling attractiveness.

And . . . the total cost of this unit is so low that it is given free with only $3.00 worth of Sherbits at retail price.

Chicago Molded is equipped to handle any job . . . simple or complex . . . either compression, injection or plunger molded . . . in any quantity. Our practically unlimited facilities are backed by more than 30 years of experience in plastics. That's why leaders of industry consider Chicago Molded their primary source of supply. And it's a mighty good reason for discussing your next plastics job with us. Just write, wire or phone. There's no obligation.

CHICAGO MOLDED PRODUCTS CORPORATION

1046 N. Kolmar Ave. Chicago 51, Illinois

Representatives in principal industrial centers

COMPRESSION, INJECTION AND PLUNGER MOLDING OF ALL PLASTIC MATERIAL

EDITORIAL

Mass Markets—and First Impressions

WITH few exceptions, plastics are materials for mass production, and plastics products are made for mass markets. Which means that realistic pricing must be put into effect at the time the plastic product is introduced to the buying public.

A significant and dangerous departure from this basic principle has been observed recently in the marketing of polyethylene bottles at retail.

In *The New York Times* for December 7, 1949, a Fifth Avenue department store advertised a plastics travelling kit in which to "transport your colognes and lotions wherever you go. Includes leak-proof atomizer and two four-ounce bottles nesting in a sturdy plastic case—$3.50." At the same time, single empty four-ounce polyethylene bottles were selling elsewhere at as much as 59 cents each.

The travelling kit included two ordinary four-ounce Boston Round plastic bottles with gold plated caps and a two-ounce Boston Round bottle with a plated brass atomizer cap, all three contained in a sewn vinyl envelope closed with two dome fasteners.

In lots of 10,000 and at top prices, the complete product could not possibly have cost more than 45 cents. Two 4-oz. bottles at 9.4 cents each, plus one 2-oz. bottle at 8 cents, plus two gold-plated metal caps at 1½ cents each, plus one gold-plated brass atomizer cap at 3 cents, plus a vinyl kit bag with fasteners at 12 cents equals 44.8 cents per unit for an item selling at $3.50 retail! And any good purchasing agent could get this cost under 40 cents with a little effort.

It must be obvious to any packaging merchandiser that the big market for polyethylene bottles will not be in travelling kits or in single-bottle sales to women; the big market will be as packaging for mass-produced cosmetics and other liquid products. Yet the introduction of these bottles to the public at such fantastic prices is bound to have an adverse effect on the natural markets ahead.

Any cosmetic manufacturer unacquainted with the true costs of these bottles, seeing three of them offered for $3.50 at retail, would not be likely to rush out and acquaint himself with the facts. Even if he were aware that this was a piece of obvious over-pricing, he might be afraid to put up his line in these bottles, because the public is being convinced that they are very expensive. If he were to bring out, say, a line of cologne in a 4-oz. polyethylene bottle at around the $1.00 mark, the buyer might think that the cologne couldn't be much good because she had been led to believe that the package was expensive.

This is obviously a case where an enterprising entrepreneur has jumped into a market, determined to make a quick killing, regardless of the future.

For their own protection, manufacturers of plastics products must exert every effort to prevent these products from being retail-priced out of mass markets at the time of their introduction.

As to the particular travelling kit mentioned above: it is an excellent item which somebody ought to put on the market at about half the price.

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Circulation Department
Circulation Manager: FREDERICK A. KLEIN
32 Broadway, New York 4, N. Y.
Tel., WHitehall 4-4782

Executive and Editorial Offices
122 E. 42nd St., New York 17, N. Y.
Tel., MUrray Hill 3-0655

Branch Offices
Chicago 1: 221 N. La Salle St.
J. M. Conners Tel., Financial 6-3450

Cleveland 14: 815 Superior Ave.
R. C. Beggs Tel., Superior 0737

Los Angeles 13: 816 West Fifth St.
James C. Galloway Tel., Mutual 8335

London, England: Transatlantic Publicity, Ltd., 20/21 Broad Street Ave., Bromfield St., London E.C.2
Advertising Manager: L. H. Dolaro
European Editor: Howard Williams

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Bakelite case molded for our 45 R.P.M.
record changer.
The Richardson people did a swell job
for us on this cabinet and, best of all, they
maintained their promises to a rush schedule.
Believe me, we are grateful.
From a letter of
Oak Mfg. Co. on cabinets
MOLDED by RICHARDSON
for their new 45 R.P.M.
automatic record changer

RICHARDSON MOLDING SERVICES

This sturdy record changer cabinet, molded by Richardson for Oak Mfg. Co., is only one of thousands of parts Richardson has molded efficiently, economically and on time for scores of manufacturers.

These cabinets come from the molds with a smooth, attractive finish that makes further finishing operations unnecessary.

Richardson experience in molding plastics produced this cabinet with tapped machine screw holes accurately spaced for quick, easy assembly. Also, Richardson experience pointed the way to produce the job at minimum cost.

Hundreds of manufacturers have found that Richardson's extra experience, extra facilities and extra know-how have paid important dividends. May we discuss with you your next plastic molding job?

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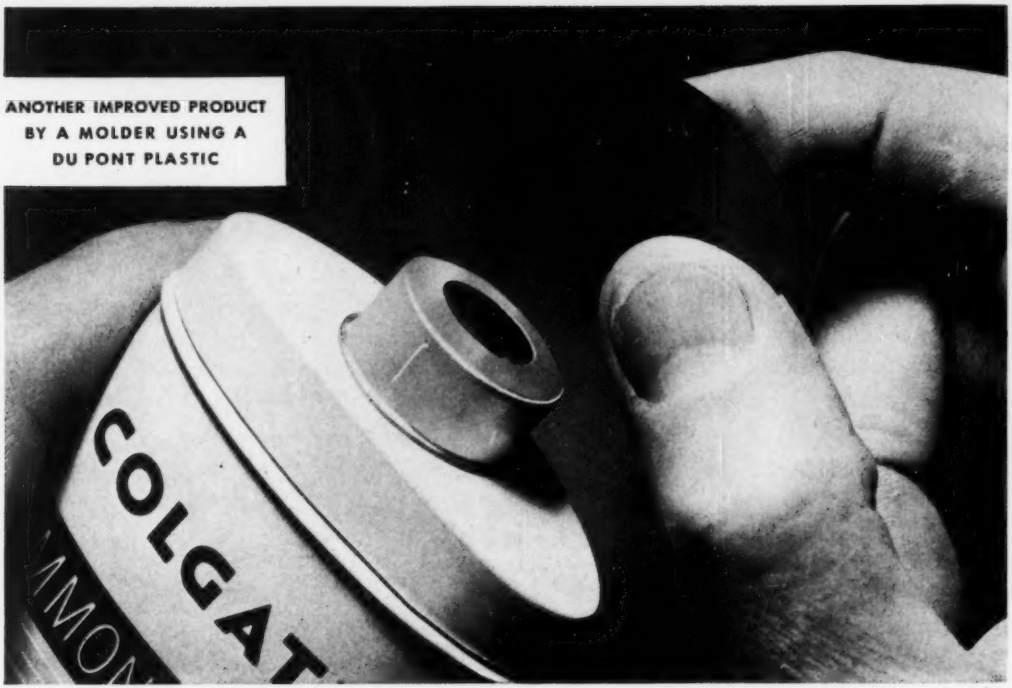

TOPS IN TOPS

Low-cost closures of Du Pont polythene fit snugly, are easy to remove, always look their best

THEY look better, perform better, they're economical. That's why Colgate tops off its talcum and ammoniated tooth powder containers with

* * *

WHAT'S NEW. This specially shaped weaning cup of tough Du Pont nylon plastic won't break or chip . . . can be sterilized in boiling water. The strength and resiliency of nylon made possible this unusual molding job in which the top curves into a diameter smaller than that of the body of the tumbler. For this application, only nylon could be molded with such a thin wall and successfully sprung from the mold. (Tumbler designed by Midwest Consultants, Inc., St. Louis; molded and silk-screened by Arnold Brilhart, Ltd., Mineola, N. Y., for Pet Milk Co., St. Louis)

closures of Du Pont polythene plastic. Polythene closures have the resilience to accommodate slight variations in container-top dimensions. Hence they fit snugly, yet permit easy removal. And they don't chip, peel, or become disfigured in use.

Polythene closures are economical. Material cost is low, and the light weight of polythene permits more closures per pound than would be possible with other materials. The need for liners is eliminated because of the snug fit and because polythene is tasteless, odorless, non-toxic, and inert to most packaged ingredients. Too, polythene is available in a wide range of colors, and the ease with which it can be injection-molded permits great versatility of design.

In addition to its variety of uses in the packaging field, polythene has won an important place in the electrical and chemical industries, as well as in a host of consumer items. Maybe you, too, can take advantage of its unusual combination of properties to produce a better product economically. Du Pont representatives will be glad to work with you. Write today for free literature on polythene and other versatile Du Pont plastics.

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Plastics Sales Offices: 350 Fifth Avenue, New York 1, N. Y.; 7 S. Dearborn Street, Chicago 3, Ill.; 845 E. 60th Street, Los Angeles, Calif.

Polythene closures molded by Sameric Engineering Co., Riverdale, N. J., for Colgate-Palmolive-Peet Co.

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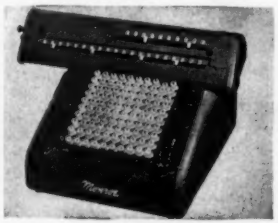
Celanese* PLASTICS

REMINGTON RAND ELECTRIC TYPEWRITER
Keys molded by Electric Manufacturing Co., Inc., San Francisco.



MONROE CALCULATOR

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A NEW, TROUBLE-FREE
PELLETIZING MACHINE
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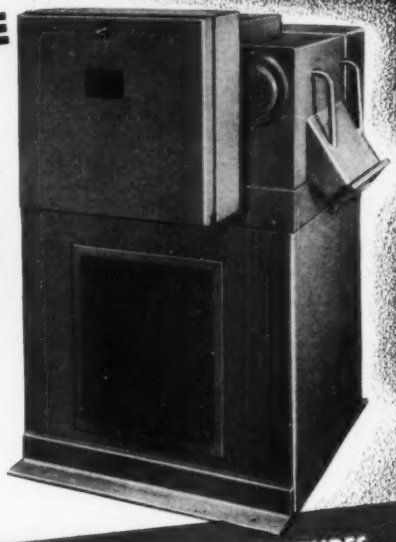

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CUMBERLAND

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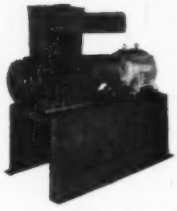
CUMBERLAND



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Large capacity. Double hung construction. Easy to inspect, dismantle, and adjust. Further details are in Bulletin 200.

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Third Anniversary!

Monsanto's "Plastics Merchandiser" begins its fourth year of service

Pioneer Merchandising Aid does unselfish job of promoting finished products for Molders

This month Monsanto's "Plastics Merchandiser," a milestone in the plastics industry, passes its third birthday. Since its inception, when it was dedicated to offering superior merchandising assistance to plastics molders, this pictorial periodical has promoted literally thousands of molders' products to volume retail buyers in department, variety, and specialty stores and chains all over the country. Over 5,000 retailers receive it *regularly*, and *use* it as a valued source of information about new products made with Monsanto plastics. Scores more request it every month.

Special issues of the "Plastics Merchandiser," chuck-full of illustrations and buying data on hundreds of new items molded of Monsanto plastics, tie in with Monsanto's national advertising and form the basis for half-a-dozen huge, timely retail promotions each year. Several *thousand* retail stores and chains participate in each promotion (on housewares, or toys, or picnicware, for example), using the colorful, sales-appealing counter and window display material Monsanto makes available to them without cost (streamers, banners, counter cards, easels, etc.).

This broad recognition and great retail-demand for Monsanto promotional assistance (and for the quality products made of Monsanto plastics) means *more and more* sales for plastics molders. If you are not now using Monsanto plastics, it will pay you to investigate the advantages of Monsanto quality, service, and dependability. Write today, or use the coupon, for complete information on how Monsanto's wide range of plastics can help *your* product. There's no obligation.

Other Monsanto Services to the Plastics Industry... Aids to the Molder and Fabricator

1. Continuing full-scale retail promotions
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5. Special-industry promotions
6. Trade and industrial advertising
7. Advertising to business management

MONSANTO
CHEMICALS—PLASTICS

SERVING INDUSTRY... WHICH SERVES MANKIND

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Plastics Division, Dept. MPLP 26
Springfield 2, Mass.

Please send me your booklet, "What Monsanto Plastics Can Do For You."

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

CREATIVE CUSTOM MOLDING

The above illustration is another example of CRUVER'S versatility in the Industrial Custom Molding Field.

Produced for Vision Visor, Inc. of Chicago, who assemble the colored Lucite castings into metal framework for installation on automobiles.

Two castings are used for a set, each weighing 26 ounces and molded in our 40 ounce press

CRUVER

MANUFACTURING CO.

2460 W. JACKSON BLVD., CHICAGO 12, ILL.

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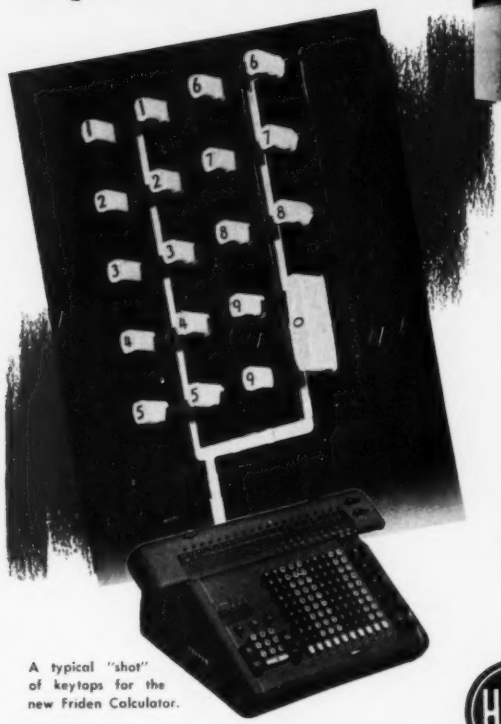
DETROIT MINNEAPOLIS NEW YORK

CLEVELAND ST. LOUIS

NOW...

AN H-P-M AUTOMATIC *Two Color* Injection Molder!



A typical "shot" of keytops for the new Friden Calculator.

FRIDEN SAVES OVER $3,000 PER MONTH ON KEYTOP PRODUCTION!

Now it is possible to automatically mold two contrasting colors in a single injection machine. This revolutionary H-P-M process has been proven by Friden Calculating Machine Company with remarkable savings in production costs. Keytops, dials, knobs, name plates ..... practically any item requiring two-color reproduction is a cinch for this new machine.

You will save costs on labor, material handling and at the same time you'll get a far superior product ..... one with colors that do not wear off with use. Want to know more about this amazing machine? Call in a nearby H-P-M engineer to explain what it will do for you. Write today for more information.

The Hydraulic Press Manufacturing Company
1010 Marion Road Mount Gilead, Ohio, U. S. A.

HPM

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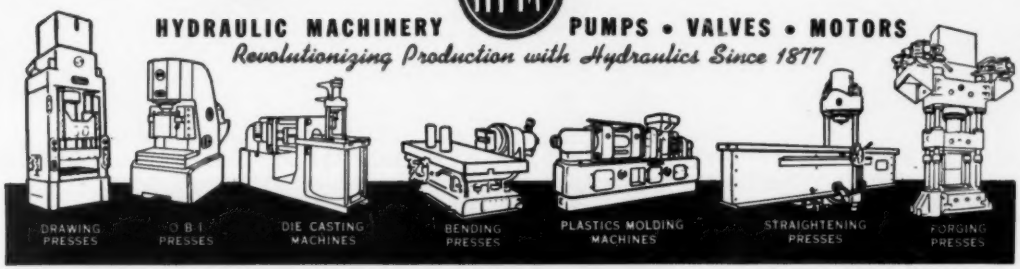
Revolutionizing Production with Hydraulics Since 1877



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SEMI-AUTOMATIC W-S 2 OZ. VERTICAL

MANUFACTURERS OF THE MOST COMPLETE LINE OF HYDRAULIC MACHINERY

See us at the
National Plastics Exposition
Chicago — March 28-31
Booth 207

9-J-43

INJECTION MOLDING MACHINE

READY FOR YOU... SEE IT PRODUCE

FIRST again, Watson-Stillman engineering ingenuity and production "know-how" have ready for *YOUR* inspection and purchase an inexpensive but amazing *NEW* production tool that will be an immediate *PROFIT-MAKER.*

Economical in *FIRST* cost, the NEW W-S 2 oz. Semi-automatic Vertical Injection Molding Machine serves in a dual capacity. Low operating cost makes it ideal for laboratory and development work where a variety of small items must be molded at minimum expense. Or, its full capacity can be utilized wherein its speed and operating efficiency make it an economical small item large-scale production tool.

Semi-automatic with SAFETY controls and features heretofore only considered possible in large machine design and construction, the *NEW* W-S Vertical Injection Molding Machine—with all the advantages you could possibly desire in a 2 oz. machine—is on parade—*NOW*—ready to be inspected—not in graph, blue print or production stage—actually die equipped and producing for one of the leaders of the industry. And, all you have to do is make a date to see for YOURSELF.

The specifications indicate why leaders are rapidly adopting the W-S 2 oz. Vertical. They'll help you visualize what this machine can do in your plant . . . to see it working give us a call—No obligation.

SPECIFICATIONS

Capacity of hopper	15 lbs.
Capacity of hopper feed	7½ cu. in.
Maximum ounces per shot, acetate	2
Plasticizing capacity of cylinder per hour	25 lbs.
Maximum cycles per hour	300*
Diameter of injection plunger	1¼
Diameter of hydraulic injection cylinder	5
Stroke of injection plunger	6
Injection pressure per sq. in.	19,000 lbs.
Maximum hydraulic system pressure	1,200 lbs.
Clamping capacity	36 tons
Stroke of clamping ram	8
Diameter of clamping cylinder	8¾
Daylight opening	15
Minimum die thickness	7
Maximum die sizes	12" x 13"
Rated maximum power consumption of heat units	2.0 K.W.
Motor hp.	5
Type of pumps used	Vickers
Oil reservoir capacity	40 gal.
Floor space required	3'3¼" x 3'4½"
Overall height	8'1½"
Shipping weight	3,500 lbs.
Speeds	
Die closing 160"/min.	Die opening 160"/min.
Injection—forward 84"/min.	Injection—return 190"/min.
Max. injection speed at 19,000 psi injection pressure	84"/min.

*Depends on molding material and mold construction.

WATSON-STILLMAN HYDRAULIC MACHINERY DIVISION

Established 1848—Factory and Main Office: Roselle, New Jersey Branch Office: Chicago, Ill.

REPRESENTATIVES

Birmingham 3, Ala.....George M. Meriwether
Denver, Colo.....Overgard Machine Tool Co.
Detroit, Mich.....Watson-Stillman Co.
Duluth, Minn.....Anderson Machine Tool Co.
Indianapolis, Ind. W. K. Millholland Machinery Co.
Los Angeles 11, Cal.....H. M. Royal, Inc.
Pittsburgh, Pa.....Stanley Berg & Co.
Portland, Ore.....Machinery & Tool Supply Co.
Rochester 8, N. Y.....Watson-Stillman Co.
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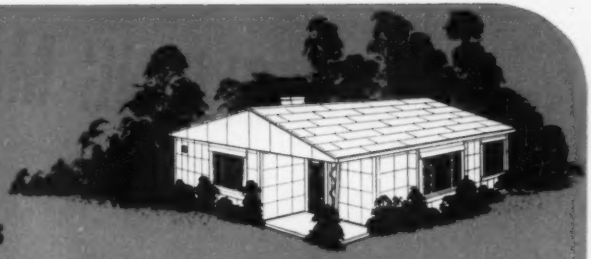
Foreign Sales Representatives: OMNI PRODUCTS CORP., 460 Fourth Ave., New York 16, N. Y., Correspondents Throughout the World

YARDLEY

EXTRUDED

PLASTIC GASKETS



for every purpose

- ★ METAL BUILDINGS
- ★ REFRIGERATORS
- ★ APPLIANCES
- ★ STORM WINDOWS
- ★ DRY GLAZING

Yardley has successfully solved the problem of permanently sealing outside weather joints on panels, corners and windows of nationally-known metal houses and commercial buildings.

The cross section here shown is a vinyl dry glazing especially designed for use in aluminum primary windows.

If you use gaskets of any kind, consult Yardley. Our engineers have perfected modern production techniques that can save you time and money on exactly the right strip for your specific needs.

Depend on us for pin-point accuracy in design and tolerances that assures consistent uniformity. We extrude and fabricate any thermoplastic material.

There's an experienced Yardley representative near you. We will send him promptly.

A FEW TYPICAL CROSS SECTIONS

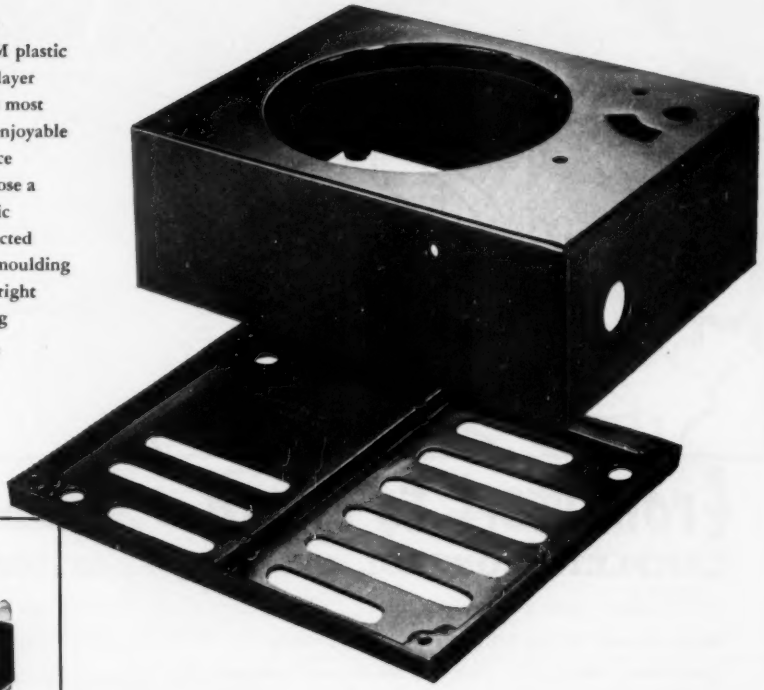
YARDLEY PLASTICS CO.

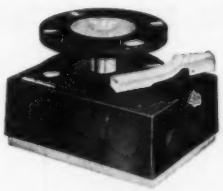
142 PARSONS AVE. · ADams 9315 · COLUMBUS 15, OHIO

Here's one for the record–

(RCA Victor's New Vinyl Plastic Record)

Designed for the sensationally successful RCA Victor 45 RPM plastic records, this compact record player provides recorded music at its most convenient, inexpensive and enjoyable best. In combining performance with economy, RCA Victor chose a special maroon phenolic plastic for the cabinet and base—selected Kurz-Kasch for the exacting moulding job. This combination of the right plastic and the right moulding facilities produced the sturdy, attractive unit pictured here.





Record Player by RCA Victor
Cabinet and Base by Kurz-Kasch

Here's a shining example of cooperative planning in plastics. RCA Victor and Kurz-Kasch worked together to produce these carefully engineered mouldings on a quantity basis—with the results you see above. In *your* case, good results are just as certain. When you want a complete job—where long runs and delivery schedules are important—we're ready to handle it for you. We've got the staff, the equipment and the reputation necessary to solve your plastics moulding problems. Let one of our engineers tell you more about our facilities.

Kurz-Kasch

FOR OVER 33 YEARS PLANNERS AND MOULDERS IN PLASTICS

Kurz-Kasch, Inc. • 1415 South Broadway • Dayton 1, Ohio

BRANCH SALES OFFICES: New York, *Lexington 2-6677* Chicago, *Harrison 5473* • Detroit, *Trinity 3-7050* Philadelphia, *Granite 2-7484* • Dallas, *Lakeside 1022* Los Angeles, *Prospect 7503* • St. Louis, *Rosedale 3542* Toronto, Canada, *Adelaide 1377*.

EXPORT OFFICE: 89 Broad Street, New York City, *Bowling Green 9-7751*.

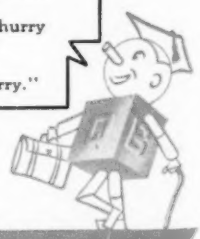
from start to finish... "CUBEE" TAKES COMPLETE CONTROL OF YOUR PLASTICS PROBLEMS

"Cubee" does a complete job . . . when you use our services you get the benefit of the *entire* organization working on your problem — designers, die makers, molding machine operators — everyone. You see, we have all the services available to you to help you solve your problems.

Five of the key people here have a total of more than 75 years of experience in this business — and remember, this is a relatively new field. That's a lot of know-how — and it's yours for the asking. Let "Cubee" take over *your* plastics problems — from Start to Finish.

Q-B Says:

"Cubee solves your plastics puzzle,
And he does it in a hurry
Just toss the job in Cubee's lap
And eliminate a worry."



Quinn-Berry Corp.
PLASTICS

2652 WEST 12th STREET, ERIE, PA.

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11341 Woodward Avenue
Detroit, Michigan
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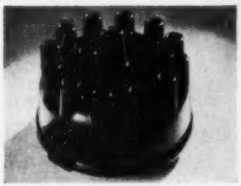
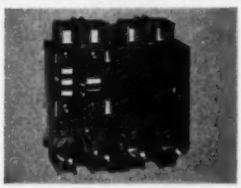
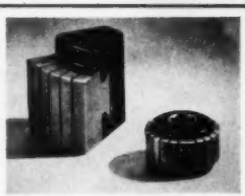
HOW TO CHOOSE YOUR
ELECTRICAL GRADE
PHENOLIC MOLDING COMPOUND

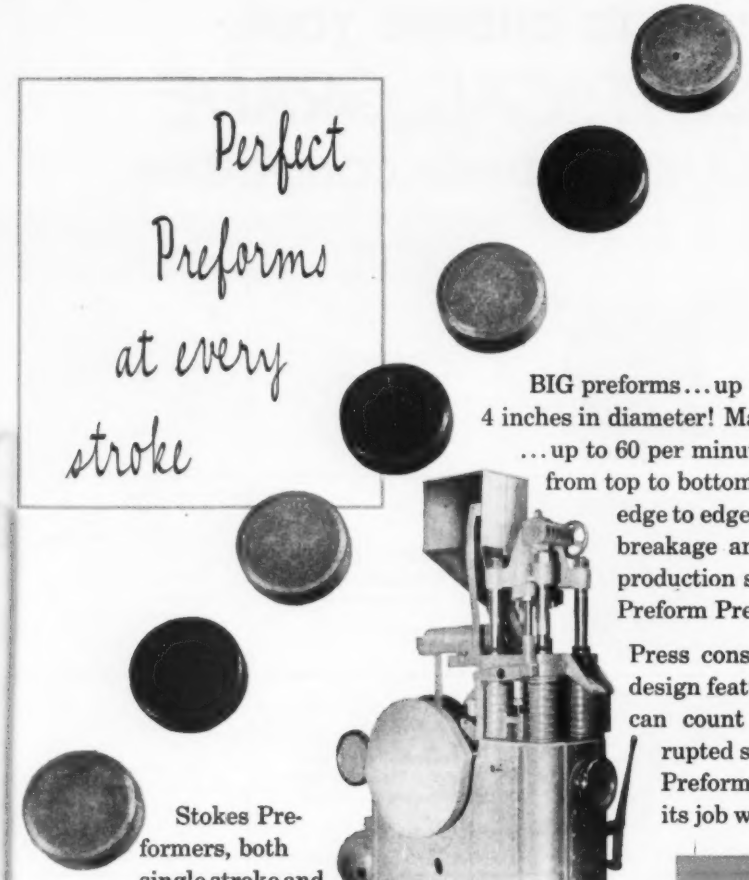
What do you make?		Properties you need	DURITE recommends
Automotive parts— distributor heads, magneto housing and cover, etc.		High dielectric properties, general durability.	For highest water-resistance: 570 For lower cost: 560 Black or brown
High voltage relay and fuse blocks, also terminal blocks.		High dielectric properties, high heat resistance.	For highest dielectric properties: 570 For highest heat resistance: 572 Black or brown
Instrument housings, switch handles, exposed parts.		Lustrous finish, good general strength and dielectric properties.	For best finish: 525 For higher impact properties: 530 Black or brown
Electric motor parts, molded commutators, etc.		Highest heat resistance, good dielectric properties.	For highest heat and water-resistance: 572 Black or brown
X-Ray equipment housings and other office or clinical equipment.		Smooth black finish, good general strength, and dielectric properties.	Best "general purpose" characteristics with high dielectric strength: 745 Brown or black

For products that have to "stand the gaff", molders turn to DURITE, specialists in phenolics for General Purpose, Heat-Resistance, Electrical-Resistance, Impact-Resistance—and any special properties you require. Address:

THE BORDEN COMPANY · CHEMICAL DIVISION
Dept. MP-20, 350 Madison Avenue
New York 17, N. Y.

DURITE
Molding Powders · Binding Resins · Cements

Perfect Preforms at every stroke



BIG preforms... up to 4 inches in diameter! Made fast ... up to 60 per minute! Uniform from top to bottom... sharp and firm edge to edge... free from crumbling, breakage and waste!... that's the production story of the Stokes 294 Preform Press.

Press construction is so rugged, design features so sound, that you can count on years of uninterrupted service. The Stokes 294 Preformer does every part of its job with amazing perfection.

Stokes Preformers, both single stroke and rotary, fit profitably in production set-ups. Mail the coupon *today* ... for detailed, interesting data.

STOKES MAKES Automatic and Semi-Automatic Molding Presses, Plunger Presses, Closure Presses, Preforming Presses, Industrial Tabletting and Powder Metal Presses, Vacuum and Special Processing Equipment, Water Stills and Special Machinery.

F. J. STOKES MACHINE COMPANY

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F. J. STOKES MACHINE CO.
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Please ... all the data on the Stokes 294 Preformer.

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PLASTICS
Sheets • Rods • Tubes
cellulose acetate (Nixon C/A)
cellulose nitrate (Nixon C/N)
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(Nixon C/A/B)
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cellulose acetate
ethyl cellulose
...and now
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for close personal service on orders large
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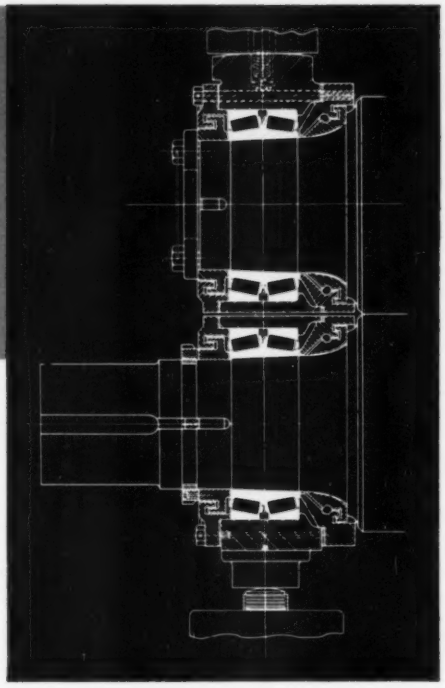
How Timken® Tapered Roller Bearings Help To Improve Plastics Production --Modify Costs



Timken bearing application for roll necks of plastics and rubber mills.

In plastics mills the use of Timken Balanced Proportion Bearings helps to make mills more rigid, because these bearings make possible larger roll neck diameters, with 50% to 60% increased roll neck strength and correspondingly higher bearing load ratings — up to 40% higher than with previous designs of tapered roller bearings, size for size.

In plastics calenders, where precision is the all-important factor, Timken bearings have proved their ability to provide and hold the extremely close gauge tolerances required in rolling the finest plastic sheet and film.

The advantages and versatility of Timken bearings are made possible by (1) scientific tapered design, (2) ability to carry radial, thrust and combined loads, (3) line contact of rolls and races assuring alignment of revolving parts, (4) superfine surface finish of rolls and races for utmost smoothness of operation and minimum wear.

Make sure you have Timken bearings in the machines you build or buy. Look for the trade-mark "TIMKEN" on every bearing.

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO • CABLE ADDRESS "TIMROSCO"

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▷ BEARING TAKES RADIAL ▯ AND THRUST —▯— LOADS OR ANY COMBINATION

IMPORTANT

AGAIN . . . . GERING SAVES YOU MONEY!

YOU TOO CAN OBTAIN THE MANY ADVANTAGES ENJOYED BY HUNDREDS OF MOLDERS USING THIS SERVICE

EVERY DAY YOU DELAY MEANS MONEY OUT OF YOUR POCKET.

YOU SAVE AS MUCH AS 8¢ PER LB. ON SPECIAL COLORS

YOU GERING

Order [illegible] at no extra cost to you. **GERING** will [illegible] your instructions. Your colored Polysytrene returned in dust free internally lubricated Pellet form. **GERING** absorbs any processing losses. . . Exact color matches and constant quality control are a **GERING** specialty.

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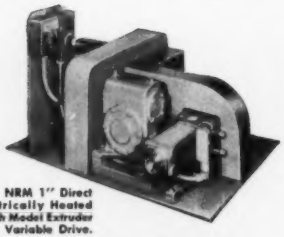
OFFICES and PLANT: NORTH 7th ST. KENILWORTH, N. J.

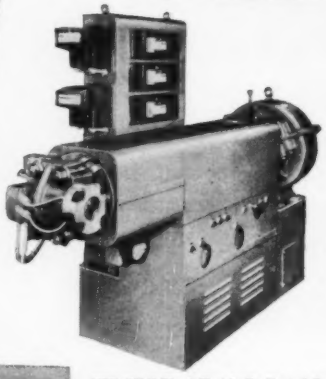
SERVICE • QUALITY • DEPENDABILITY

ARE YOU EXTRUDING HIGH TEMPERATURE PLASTICS COMPOUNDS?



NRM 1" Direct Electrically Heated Bench Model Extruder with Variable Drive.

NRM 1½" Direct Electrically Heated Extruder.



NRM 3½" Direct Electrically Heated Extruder with Electrically Heated Crosshead.

Proven designs and features developed during *10 years* of engineering and laboratory tests devoted exclusively to the plastics *extrusion* industry are reflected in NRM Standard Line of Direct Electrically Heated Extruders.

Look at these outstanding and important features.

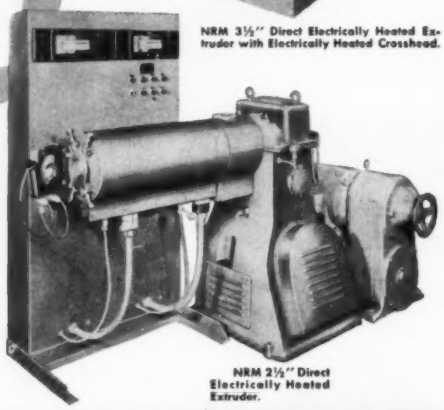
- Simplicity in operation.
- *Only three* controlled heating zones to adjust at the cylinder.
- *Absolute control over frictional heat.*
- Standard temperature range up to 750°F.
- *High capacity precision extrusions* resulting from adequate screw and cylinder length.
- Torpedo type or full flighted screws.
- Heavy duty gear transmissions with oversize thrust bearing.
- 6" — 8" — 10" — 12" Direct Electrically Heated Extruders are also available.

To cut production costs in plastics processing, write for your *free* copy of the new NRM Plastics Extrusion Equipment Catalog.

NRM

...the oldest name in Plastics Extrusion Equipment

NRM 4½" Direct Electrically Heated Extruder.



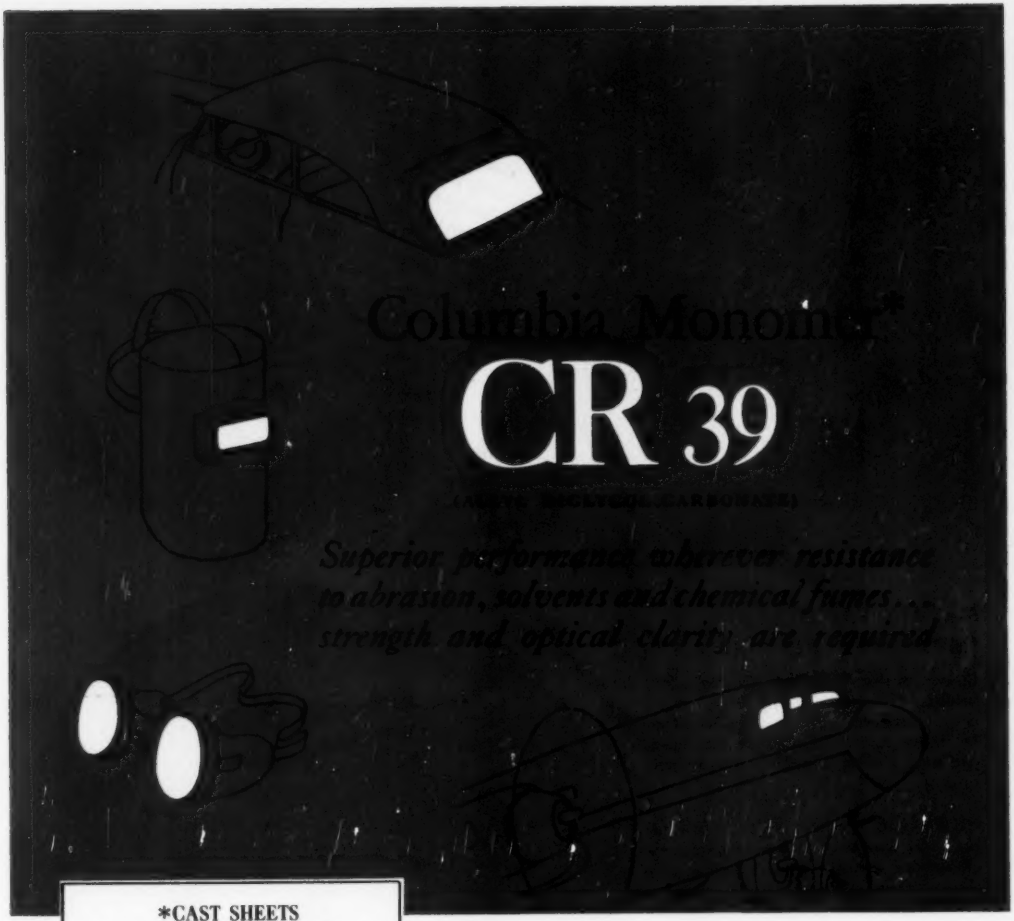
NRM 2½" Direct Electrically Heated Extruder.

NATIONAL RUBBER MACHINERY CO.

General Offices: AKRON 8, OHIO

Plastics MACHINERY DIVISION

EXPORT DISTRIBUTORS: **OMNI PRODUCTS CORPORATION, 460 FOURTH AVE., NEW YORK 16, N. Y.**


Columbia Monomer*
CR 39
Superior performance wherever resistance to abrasion, solvents and chemical fumes . . . strength and optical clarity are required

***CAST SHEETS**

Columbia furnishes only the CR 39 liquid monomer. It can be obtained in cast sheets of various standard sizes, or to finished dimensions from:

HOMALITE CORPORATION
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Wilmington 166, Delaware

CAST OPTICS CORPORATION
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Mineola, New York

CR 39 is a thermosetting monomer which is rapidly increasing in its use in cast forms for various automotive, aircraft, optical and industrial applications. These include rear lights for convertible tops . . . aircraft enclosures and instrument panels . . . welders' helmets and safety goggles . . . clear glazing in plants where certain chemical fumes are encountered. It is also a useful material for resin modification.

If such properties suggest advantages for your applications we'll be glad to furnish complete information. Just write Pittsburgh Plate Glass Company, Columbia Chemical Division, Fifth at Bellefield, Pittsburgh 13, Pennsylvania.

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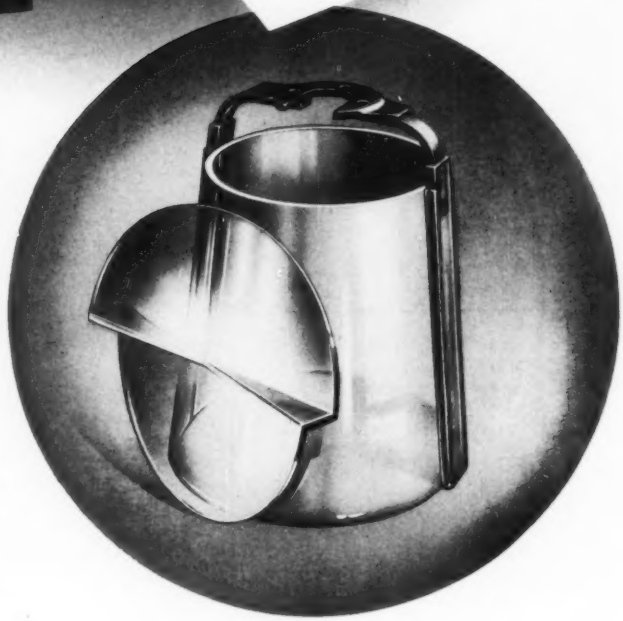
PAINT • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

CAN YOUR PRODUCT BE IMPROVED BY MACOID?

Many of our clients examine their products with this question in mind, "Can I make this product better?" To this question, Macoid usually has a "yes" answer. Here's how to get the answer—Let us see the product or its blueprints. We'll make up experimental models for you to test. Once the order is placed, Macoid's combined facilities of designing, engineering, and production (molding or fabricating) are put to work.



MACOID FABRICATION IMPROVED THIS PRODUCT:

Electroplating tumbler (20" high, 20" wide) for electroplating very small articles. Macoid built and produced for Frederick B. Stevens Co., Detroit foundry and plating suppliers, this plastic unit.

PROBLEM: An electroplating tumbler was wanted that would give better service, longer life and greater efficiency than the expensive rubber-coated metal ones being used. Tumbler metal was getting into, and ruining, the plating solution when the rubber broke down.

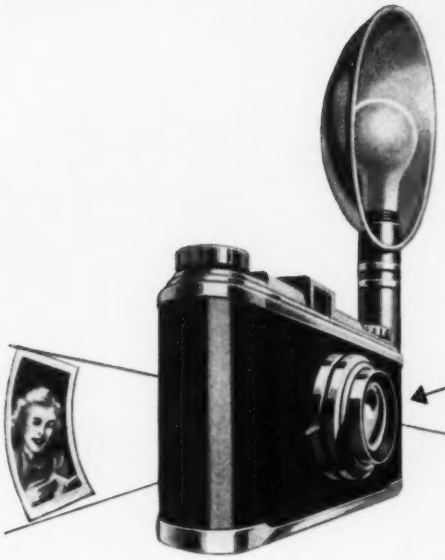
SOLUTION: The Stevens Co. brought the unit to Macoid, an experimental model was fabricated of plexiglas, and these advantages were immediately apparent:

improved insulating qualities
improved dielectric properties
longer life of unit
lower cost in the long run.

Originators of Dry Process Plastic Extrusion

DETROIT MACOID CORPORATION

Extrusion and Injection Molding • 12346 CLOVERDALE, DETROIT 4, MICH.



for molding
or
calendering

Dowtherm

for efficiency and economy in process heating

Dowtherm, the heat transfer medium for high temperatures, has economically increased efficiency and improved quality in many cases.

Dowtherm has made definite contributions to the plastics industry. Its ease of control and application assists in the mass production of nylon and phenolic and alkyd resins.

Dowtherm speeds the heating cycle and reduces labor costs. An outstanding characteristic is the accurate control it affords in obtaining temperatures between 300 and 750°F. at low pressures.

Are *you* fully acquainted with Dowtherm's higher operating efficiency? For more information write Dept. DM 15.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

SPEEDS HEATING • IMPROVES PRODUCTION

DOWTHERM

For Lower Assembly Costs—

FIT THE FASTENER TO THE JOB

with Parker-Kalon's Complete Line

With the need for cost reduction greater than ever, manufacturers are turning increasingly to Parker-Kalon Self-tapping Screws for more efficient product assembly.

Self-tapping Screws are designed to save assembly *time* — by eliminating such work-slowing operations as tapping, riveting, nut-running, and inserts in plastics. But the competitive advantages of this "short-cut" fastening method — lower production costs, simplified assemblies, improved product performance — can be lost with the wrong *type* of screw.

Parker-Kalon *fits the fastener to the job.* Originators of the Self-tapping Screw, and manufacturers of the only *complete* line, (a type and size for every metal and plastic assembly), Parker-Kalon's advice is completely unbiased.

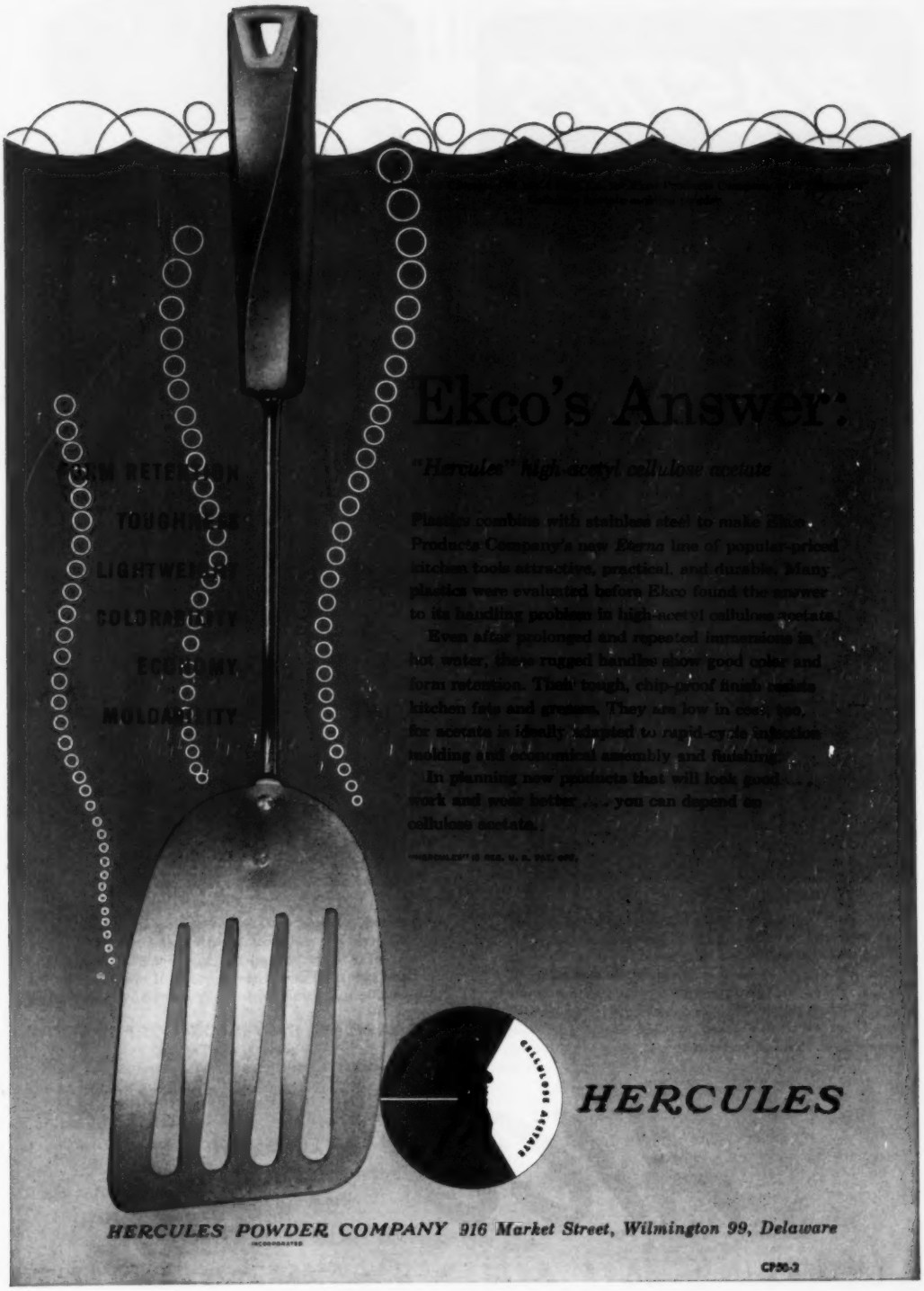
Whether your product is in the planning stage or in production, it will pay you to call in a Parker-Kalon Assembly Engineer. He can demonstrate that, 7 times out of 10, P-K Self-tapping Screws save up to 50% in assembly workhours. Or, if you prefer, mail assembly details for recommendations. Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

IF IT'S P-K . . . IT'S O.K.!

The Original **P-K®** **PARKER-KALON®**

SELF-TAPPING SCREWS

FOR EVERY METAL AND PLASTIC ASSEMBLY


Ekco's Answer:
"Hercules" high-acetyl cellulose acetate
Plastics combine with stainless steel to make Ekco Products Company's new Eterna line of popular-priced kitchen tools attractive, practical, and durable. Many plastics were evaluated before Ekco found the answer to its handling problem in high-acetyl cellulose acetate.
Even after prolonged and repeated immersions in hot water, these rugged handles show good color and form retention. Their tough, chip-proof finish resists kitchen fats and greases. They are low in cost, too, for acetate is ideally adapted to rapid-cycle injection molding and economical assembly and finishing.
In planning new products that will look good . . . work and wear better . . . you can depend on cellulose acetate.
HERCULES
CELLULOSE ACETATE
HERCULES POWDER COMPANY 916 Market Street, Wilmington 99, Delaware
CP50-2

PLASTICS

THE SEAT OF MODERN DESIGN

Thonet Bros., Inc. designed this modern bath stool to meet the high standards and rough treatment of hotel use. They wanted to produce it in quantity . . . avoid excessive weight . . . keep all the sturdiness found in clumsy old patterns. They wanted the seat in soft, pastel shades. With water resistance in mind, Aico suggested economical urea. Glossy black was added to the line with sturdy, light phenolic.

Weight . . . and cost . . . were kept low by using thinner sections and reinforcing with appropriate ribs (A). Assembly was simplified and speeded by molding in four threaded brass inserts (B). The mold was polished like a mirror to produce a lustrous sheen with no buffing. Compression molding in one of our 450 ton presses turns out these fine seats, finished except for flash removal, at a rate of better than one every ten minutes.

Plastics, adapted with understanding and molded with skill, can key many things to better acceptance in the market of today. Our portfolio of Aico Plastics Applications contains pictures and details of many actual uses of modern molded plastics. Write for your copy today.

AMERICAN INSULATOR CORPORATION
New Freedom, Pa.

AICO

PRECISION MOLDING
for over 30 years

MANY THINGS ARE BETTER BECAUSE OF PLASTICS

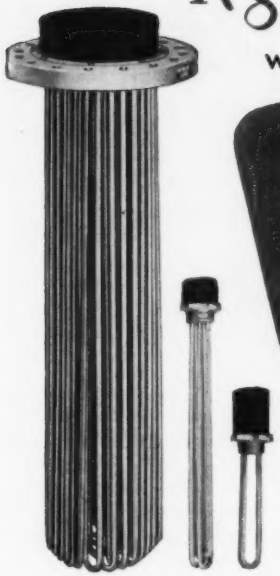
HEAT GASES AND LIQUIDS

Efficiently and Economically,

"*Right on the Job!*"

with

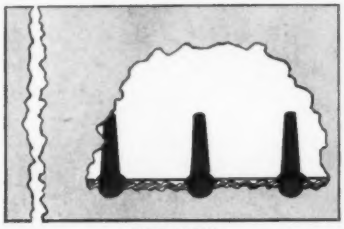
CHROMALOX
Electric
IMMERSION HEATERS



TMO Type Immersion Heaters are made in sizes up to 75 KW to operate in temperatures up to 800° F. and pressures up to 600 pounds.

CHROMALOX Tubular Immersion Heaters are used for heating compressed air and other gases: for super-heating steam; for heating liquids and Dowtherm, Prestone and similar heat-transfer mediums. They can be readily applied to high-temperature and high-pressure operations.

CHROMALOX Electric Immersion Heaters give you the *exact* temperatures you require and maintain these temperatures accurately. Dependable performance, economical operation, reduced spoilage are among other advantages gained by using these easy-to-install heaters.



SIDE VIEW FRONT VIEW

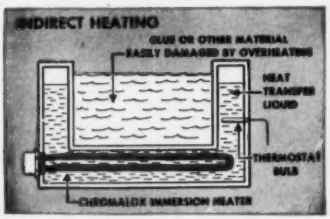
GIANT STEAM ACCUMULATOR USING CHROMALOX IMMERSION HEATERS (SIMPLIFIED VIEW)

Twenty-four TMO Heaters of 24 KW each are used in this steam accumulator (approximately 72 feet long, 8 feet diameter) to maintain 300° F steam temperature.

This installation was worked out on the job by Chromalox Application Engineers who are always ready to help solve your heating problems.

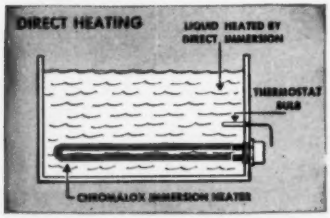
Typical Examples

of a few of the many uses for Chromalox Immersion Heaters



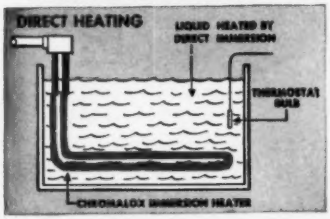
WATER OR OIL JACKETED KETTLES

Heaters are quickly and easily mounted in kettle wall; temperatures are accurately maintained manually or by automatic control. Uniform heat transfer makes this application particularly good for liquids that must be heated slowly to prevent damage by overheating.



HEATER MOUNTED PERMANENTLY IN TANK

Chromalox Immersion Heaters are welded or bolted through tank wall. Heaters are sheathed in copper, steel or alloy—as required to defeat corrosion. Temperatures are controlled thermostatically. Heat is absorbed directly and efficiently.



FOR HEAVY-DUTY IMMERSION HEATING

Low-density Immersion Heaters are especially designed for high-temperature melting-pots or salt baths. Heaters have legs to raise elements above sludge accumulation. They are quickly installed and easily removed for maintenance.

Want more Examples?

Request the fully-illustrated booklet "100 Ways to Apply Electric Heat." It contains photographs and drawings showing Chromalox Electric Heaters at work in plants throughout the United States. Write today for your copy.

IC-41

CHROMALOX

Electric Heat for Modern Industry

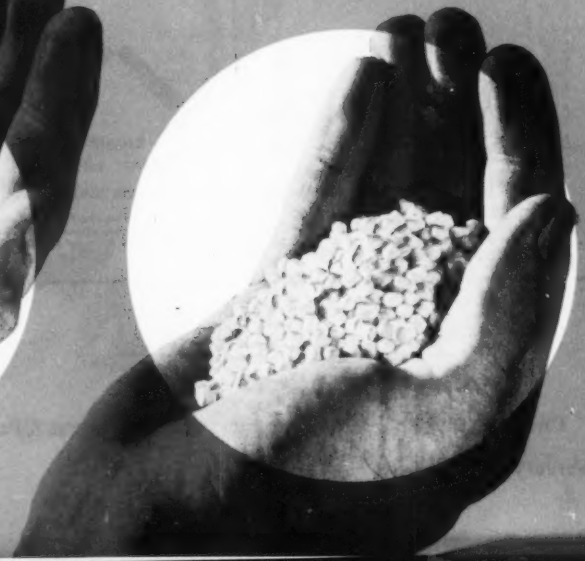
EDWIN L. WIEGAND CO. · 7503 Thomas Boulevard · Pittsburgh 8, Pa.

Molding pellets

POLYSTYRENE

ACETATE

POLYETHYLENE



VINYL

YOU'RE FOREVER FREE of troublesome materials inventory problems when the revolutionary Compounder-Extruder* takes its place in your plant. No longer is it necessary to maintain a large supply of every shade of every plastic you use. No longer need you delay operations until such time as a material supplier runs the color or formulation you want. You merely stock pigments or dyes and low-cost, bulk-purchased uncolored resins.

When your job order schedule calls for a particular color of a specific plastic, you just place the proper colorant and uncolored resin into your Compounder-Extruder together with the required fillers and plasticizers, if any. All ingredients are thoroughly intermixed in a *single pass* by the counter-rotating double worms* in the special "pressurized" compounding cylinder. And as they emerge from the extruding die they're automatically cut into pellets of the proper size and density for perfect injection molding. There's no "overrun." You process only the *exact* amount required for the job at hand.

like these

produced in your own plant in any color at low cost

COMPOUNDS AND PELLETIZES ALL THERMOPLASTICS

Your Compounder-Extruder isn't limited to a single material . . . it compounds, colors and pelletizes polystyrene, acetate, vinyl, polyethylene, methacrylate. What's more, the addition of plasticizers and fillers in no manner complicates its operation. And as a matter of fact, you can actually vary the formulation of the material you compound to fit the requirements of whatever product you intend to mold.

COSTS ARE PUSHED WAY DOWN

Using the Compounder-Extruder reduces your molding material costs to an amazing new low. When operated at or near capacity, enough is saved on compounding costs, to enable you to write off the purchase price well within the authorized depreciation period for capital equipment. Savings of additional impressive sums are effected through simplified inventory practices and plant operation procedures.

And the Compounder-Extruder gives you a *practical* method of reclaiming your scrap, too. Reprocessed "straight" or with the addition of virgin resin, it's ready for use again at minimum cost.

SIZES AVAILABLE TO FIT YOUR NEEDS

The Series 2000 Compounder-Extruder (2" double worms) has an average output of 100 pounds per hour. The largest of the five models, the Series 6000, produces fully 1300 to 1500 pounds of colored, compounded and pelletized injection molding feed every sixty minutes. Other models have intermediate production capacities.

SEND FOR DETAILED DATA

The economic significance of the revolutionary Compounder-Extruder is immediately and clearly apparent . . . its ability to reduce materials costs will be favorably reflected in the lower price of the plastics products you mold. Hence, knowing all the facts is vitally important to you. Therefore, please write today, giving full particulars about materials to be processed, output required and the like.

*Patents issued and pending

machinery division

WELDING ENGINEERS INC.

NORRISTOWN, PENNSYLVANIA

You can't beat these drums!

Your product may be one of the thousands of items for which a fibre drum is just about the perfect package. And there are some thumping good reasons why a Continental fibre drum is the best drum you can use.

Continental fibre drums can't be beat for rugged durability. They give extra protection to both expensive and dangerous articles for shipment either in this country or abroad. The closures are tight and strong —but easy to open and close.

Continental fibre drums can't be beat for shipping economy. Their light tare weight means savings at today's high freight rates—even greater savings on export shipments to countries where import duties are levied on the gross weight.

Continental fibre drums can't be beat for appearance. They are neat and trim, tailored to your product, and feature quality printing or spray painting. Each Continental drum is a style leader in its field.

Most important, Continental can't be beat for service. There are four strategically located Continental fibre drum plants ready to give you fast, economical and dependable service. Continental packaging engineers are always ready to give you sound advice on packaging problems. Backing up these engineers is a modern laboratory staffed with qualified research and development people.

Continental is big enough and flexible enough to handle any situation. Again and again Continental customers say, "You make us feel as though your fibre drum department is part of our own company." We'd appreciate an opportunity to show you how much real help and service we can deliver.

These drums can help you boom sales

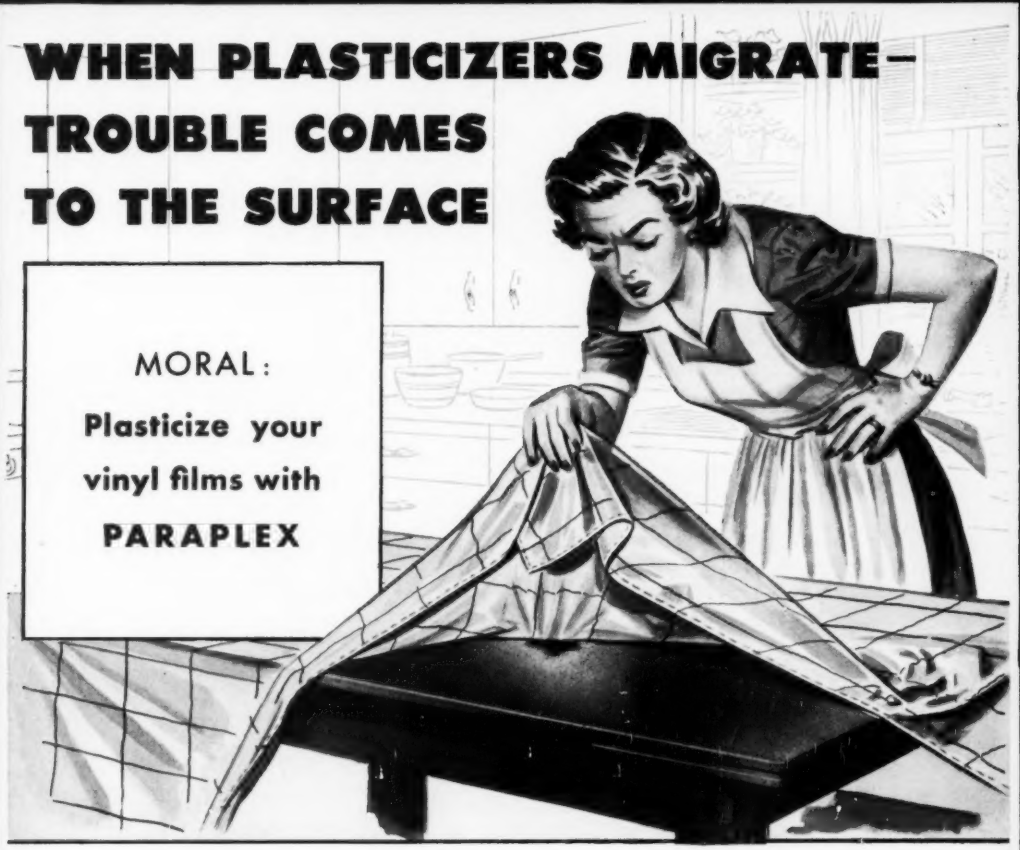
1. The famous Continental LEVERPAK drum with its unique lever-locking device gives maximum protection under hard usage. 12- to 75-gallon sizes.
2. Continental FIBERPAK drum . . . a rigid, all-fibre container in ¾- to 67-gallon sizes.
3. Continental STAPAK drum. Has fibre body with metal top and bottom. Supplied in 2- to 32-gallon sizes.
4. Continental UPAK drum. Custom-made for the shipment of rolled materials.

CONTINENTAL CAN COMPANY

PAPER CONVERTING DIVISION • FIBRE DRUM SECTION
VAN WERT, OHIO

NEW YORK • PHILADELPHIA • PITTSBURGH • TONAWANDA • CLEVELAND
CHICAGO • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • EAU CLAIRE

WHEN PLASTICIZERS MIGRATE— TROUBLE COMES TO THE SURFACE



MORAL:

Plasticize your vinyl films with PARAPLEX

You can't keep fugitive plasticizers under cover. They migrate from one surface to another . . . volatilize and leave vinyl films stiff and brittle . . . rub off on clothing . . . *ruin furniture by sticking to varnish and lacquer, by actually removing the finish!*

The PARAPLEX plasticizers are your best insurance against migration. Once a part of vinyl compounds, they stay there—despite constant rubbing, high heat, and prolonged contact with varnished or lacquered surfaces and baked finishes. They are your guarantee of permanent plasticization—of permanent customer satisfaction.

PARAPLEX G-50 is the polymeric plasticizer at a monomeric price. Its resistance to migration, volatilization, and extraction brings long life to free and supported film, to molded and extruded vinyl compounds. It processes readily and has unexcelled pigment wetting and grinding properties.

And PARAPLEX G-25 is the ultimate in plasticizing permanence. A high molecular weight polymer, it does not spew or migrate even at high temperatures. Its volatility is essentially zero; its resistance to heat and ultraviolet light, outstanding. Its extractability by oil, water, and cleaning fluids is extremely low. Long after monomeric plasticizers have fled from vinyl compounds, leaving them cracked, crazed, and embrittled, compounds plasticized with PARAPLEX G-25 *retain their initial flexibility.*

PARAPLEX *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.*

Write to Department MP-2 for technical literature describing PARAPLEX G-25 and PARAPLEX G-50.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square Philadelphia 5, Pa.

The Resinous Products Division was formerly The Resinous Products & Chemical Company

IT'S NEW STABELAN E in PASTE FORM

for VINYL PLASTISOLS • ORGANISOLS • EMULSIONS-

AS WELL AS REGULAR VINYL MILLED AND CALENDERED FILMS . . .

STABELAN E is the new well-balanced heat and light stabilizer . . . It permits higher temperatures for better films . . . STABELAN E is compatible with all tested pigments . . . Even organic reds hold their hue and age well when used with it.

STABELAN E gives excellent light fastness and outdoor aging . . . It improves the transparency of clear films . . . It gives films that do not absorb water and do not "blush".

★ ★ ★ ★

A BETTER STABILIZER FOR HIGH TEMPERATURES, ULTRAVIOLET AND OUTDOOR AGING . . .

★ FOR GIVING GOOD CLARITY OF FILM!

HARWICK STANDARD CHEMICAL CO.
AKRON 8, OHIO

BRANCHES: BOSTON, TRENTON, CHICAGO, LOS ANGELES

Skillful Molding

runs rings around mirrors

Our molding "know-how" was put to a new test in producing the Hood Ring for this Anco Spot-Master. The ring had to be highly flexible since it had to *stretch* around the mirror glass in assembling—it also had to be molded in such a way as to eliminate any possible visual diffusion or glare.

Solution of both problems first of all required the all-important but too often neglected, *careful* selection of the *correct* plastic material. Proper design, sound engineering and skillful molding craftsmanship did the rest.

Our ability to mold finer plastic products has now been greatly increased by our new plant—America's most modern plastics molding establishment. Let us put these new facilities plus our broad experience to work for you. You're sure to get better plastic products with greater sales appeal.

Spot-Master Mirror Ring Molded for Anderson Company, Gary, Indiana

Write on your letterhead for the new injection Molded and Extruded Plastics catalogue.

Or, for detailed information about ~~CHILO PLASTIC~~* pipe tubing and fittings, write for circulars containing data and illustrations.

*T. M. Reg.

ELMER E. MILLS CORPORATION

INJECTION MOLDERS and EXTRUDERS of: Tenite, Lumarith, Plastacele, Lucite, Nylon, Ethyl Cellulose, Plexiglas, Polystyrene, Styron, Loalin, Vinylite, Geon, Plexene, Polyethylene, Cerex, Forticel, ~~CHILO PLASTIC~~*, Saran, and other Thermoplastic Materials.

2930 NORTH ASHLAND AVENUE • CHICAGO 13, ILLINOIS

molded plastics and HOW they grew...

AGAIN! *First with the biggest!*
Plastic console cabinet tooled and produced by MPc to house Admiral 12½ inch television receiver.
SIZE: 34" high, 18" wide, 18¼" deep
WEIGHT: 40 pounds

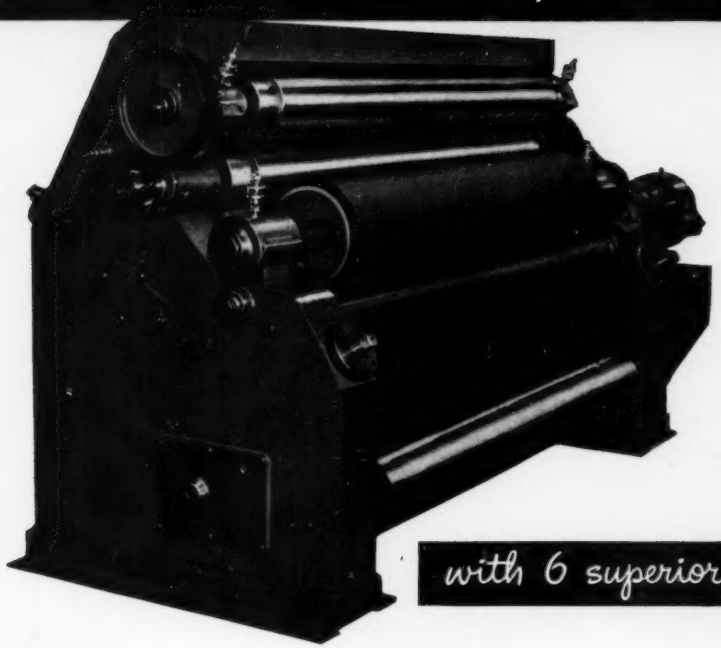
The growth of compression molded plastic castings from table-top gadgets to floor model television cabinets is largely the story of the MOLDED PRODUCTS CORPORATION. MPc had the vision, the enterprise . . . yes, the *daring* to attempt molded pieces of a size and bulk never before approached.

Today plastic television cabinets are an industry-wide feature. But the *first* plastic television cabinet was produced by MPc for Admiral in 1948. So was the first television console . . . in 1949 . . . and now the first console cabinet to house a 12½ inch television receiver.

MPc has paced the advance to ever-larger plastic castings with special multi-thousand ton presses, with unique tool-room equipment . . . and with inventive imagination. Product design engineers with big ideas are invited to consult with MOLDED PRODUCTS Corporation, 4535 W. Harrison St., Chicago 24, Illinois.

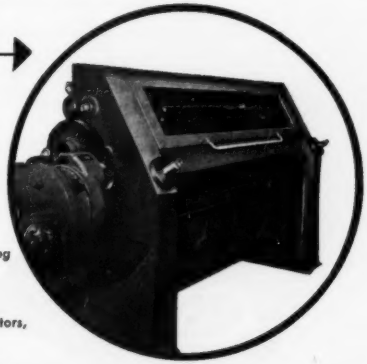
PLASTICS DIVISION
MOLDED MPc PRODUCTS
CORPORATION

Egan Reverse Roll Coater



with 6 superior features

- ***Clean, compact design*** (All adjustments housed within box frames)
- ***Pneumatic throw-out for backing roll***
- ***Chilled iron rolls ground "light tight"***
- ***Extra rigid steel frames***
- ***Herringbone drive and change gears***
- ***Completely hooded coating fountain***

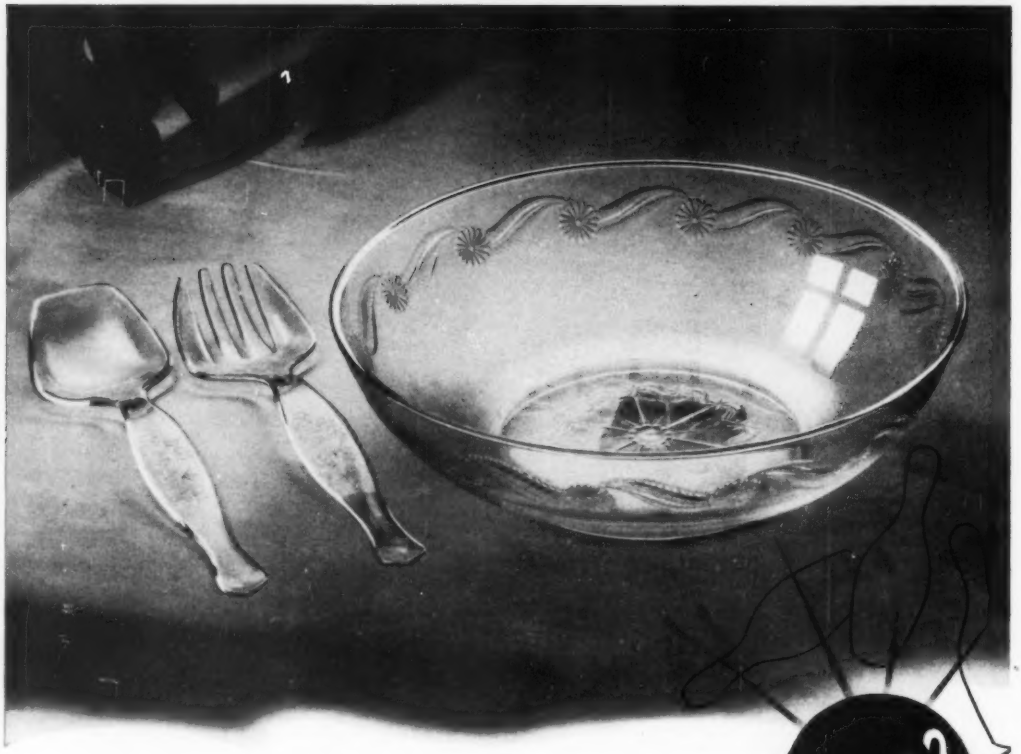


Ideal for accurate, even coatings on rough surfaces — as well as smooth ones. Every type of coating in a remarkably wide range of viscosities can be used with this Egan Machine. Write for quotation or invite our representative to call.

Send for pamphlets on coating, treating and laminating

FRANK W. EGAN & COMPANY
Bound Brook, New Jersey

Designers and builders of: Treaters, Gummers, Laminators, Crepers, Air Dryers, Waxers, Coaters, Festooners, Saturators, Printers, Embossers, Winders and Special Machinery for Paper Converting.
Export Division: The Heath Co., 150 B'way, New York 7, N. Y.
Cable Address: "Heathtech"



want to bowl a "strike" in SALES?

THERE WAS A TIME when only the very, very rich could afford salad bowls that looked anything at all like the one illustrated above.

Today, millions of homes can afford gorgeous table-ware that rivals the most expensive crystal—thanks to Columbia's creative and engineering know-how, and extensive facilities for producing plastic products in mass volume.

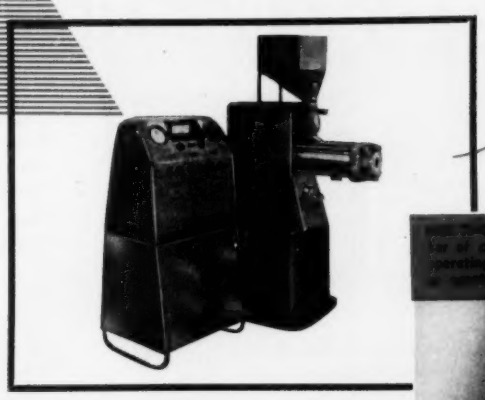
The flawlessly molded salad bowl set you see here is just one item among scores of fast-selling plastic products designed and produced by Columbia.

If you want the finest in custom molding service—for plastic products in great volume—at a sensible price—it will pay you to talk over your problem with Columbia.

COLUMBIA PROTEKTOSITE COMPANY, INC., CARLSTADT, NEW JERSEY
New York Showrooms: Empire State Building

Columbia

J-C



world's most unusual extrusions!

YOU CAN PRODUCE THEM WITH THE AMAZING TWIN SCREW RC-3

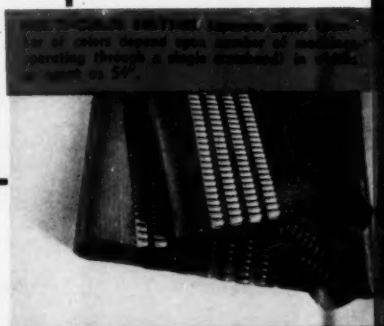
World wide acclaim has greeted the RC-3 and the wonderful extrusions which it can produce. Just think, this marvelous twin screw extruder—occupies only slightly more than eight square feet—weighs less than a ton—compounds and colors thermoplastics at high speed—reclaims scrap materials with maximum effectiveness.

With the special rotating crossheads and attachments which are available for use with the RC-3, you will be able to produce many varied multi-material and multi-color extrusions. These remarkable extrusions have wide applications and hence, sales possibilities for them are impressive.

Unique "Twin Screw" Design The patented interpenetrating twin screws of the RC-3 (both rotating in the same direction) represent by far the most efficient compounding and extruding design ever devised.

Low Cost Operation Five or more RC-3's can be tended by a single semi-skilled operator. Power consumption is low—production rates are extremely high considering the size and compactness of the RC-3.

For detailed information, write . . .



Jackson & Church

COMPANY

SAGINAW MICHIGAN

WORK WELL DONE, SINCE '81

Patents Applied For

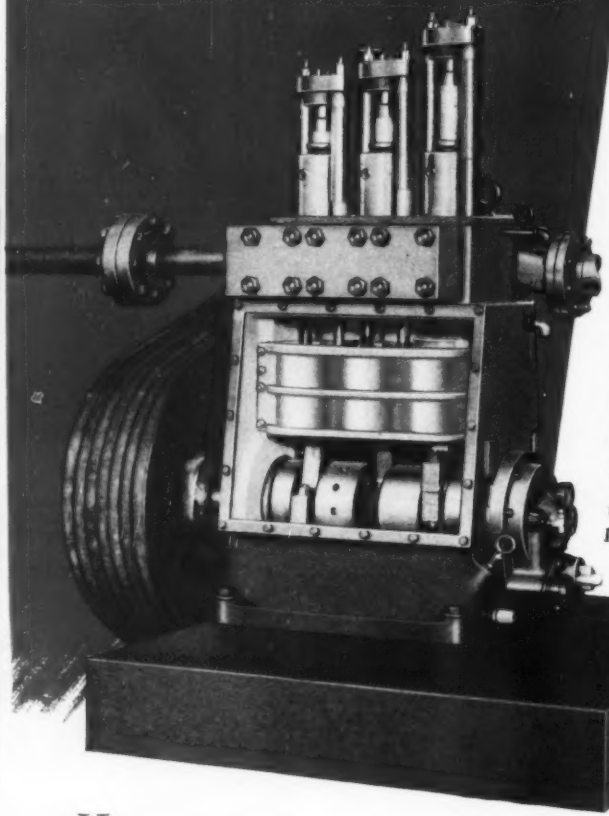
R. H. Windsor Ltd.

MANUFACTURERS UNDER L.M.P. PATENTS

16 Finsbury Sq. London, E.C. 2 England

IT'S NEW!

Aldrich 5" Stroke Direct Flow Pump Series



The ALDRICH 5" Stroke Direct Flow Pump is *new* in design! *New* in sectionalized replacement elements! *New* in price!

These pumps, built in standard Aldrich series with 3, 5, 7 or 9 cylinders, range from 100 to 275 hp and provide for those pressures normally required in industrial operations.

Look at these *new* design features: a *sectionalized* fluid-end — of distinct advantage in that individual sections can be replaced *at a fraction of the cost of an entire end unit;* close clearances to handle light liquids at high volumetric efficiency; easy access to valve assemblies; a wide choice of plunger sizes — changeable without removing stuffing box liners; and throughout this 5" series all wearing parts other than main bearings are interchangeable.

Here is a pump, at a new low in price, designed for economy, reliability, accessibility and low maintenance. Send for Data Sheet 64 for full details on how a new Aldrich 5" Stroke Direct Flow Pump can assure you *better* service and *improved* economy. Write today:

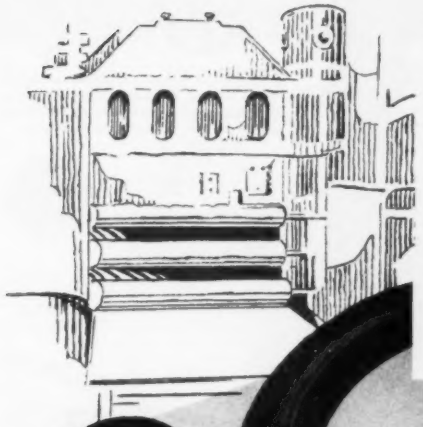
Representatives: Birmingham • Bolivar, N. Y. Boston • Chicago • Cincinnati • Cleveland Denver • Detroit • Duluth • Houston Jacksonville • Los Angeles • New York • Omaha Philadelphia • Pittsburgh • Portland, Ore. Richmond, Va. • St. Louis • San Francisco Seattle • Spokane, Wash. • Syracuse • Tulsa

THE ALDRICH PUMP COMPANY

6 GORDON STREET, ALLENTOWN, PENNSYLVANIA

All Aldrich Pumps Have **STAYING POWER**

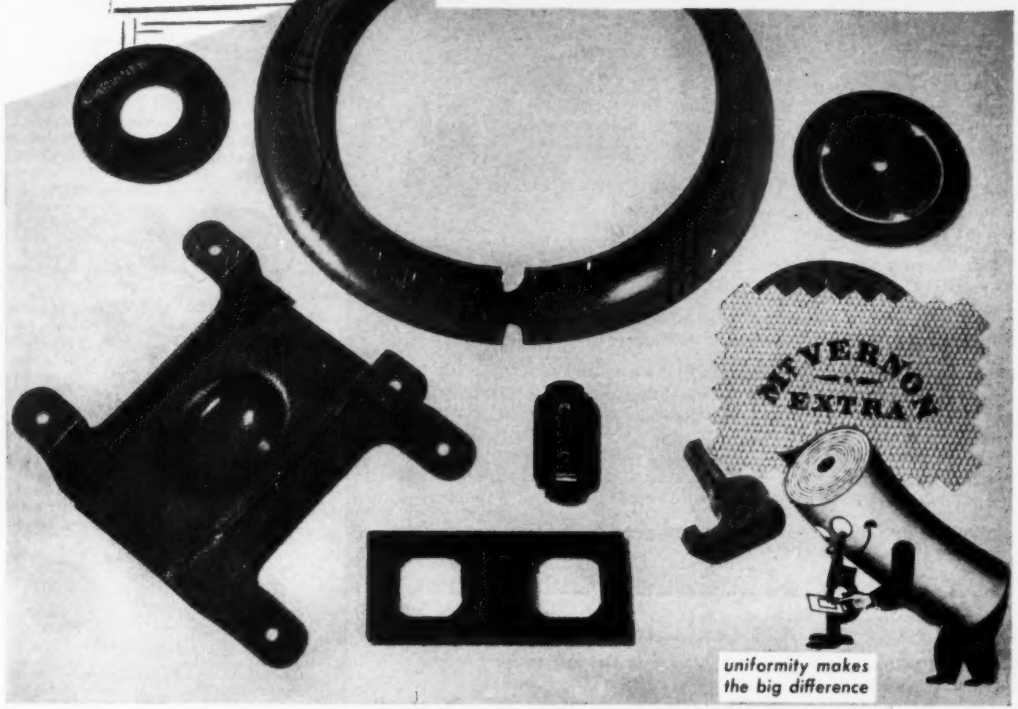
Even Penetration with Mt. Vernon Extra



Mt. Vernon Extra's greater uniformity gives you the even penetration you need for strong, durable laminates. That's why so many who specify laminating fabrics use Mt. Vernon Extra regularly.

It's all in the way Mt. Vernon Extra is produced—from top grades of cotton, under rigid laboratory controls, to the precise standards of tolerance required for successful lamination.

For laminating fabrics you can depend on to give you consistent quality in your products, specify Mt. Vernon Extra.



Mt. Vernon-Woodberry Mills

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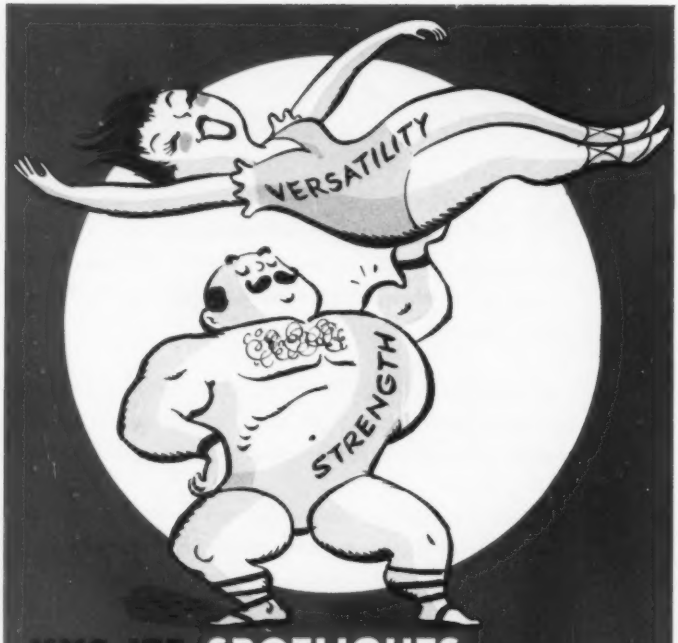
40 WORTH ST. • NEW YORK

Branch Offices: CHICAGO • ATLANTA • BALTIMORE • BOSTON • LOS ANGELES • AKRON



KYS-ITE SPOTLIGHTS STRENGTH AND VERSATILITY

- Need more strength in that compression molded part? Specify Kys-ite. Kys-ite is rugged, durable, tough . . . so strong it can . . . and often does . . . replace metal.
- Versatile, too. Name the characteristic needed for your finished product . . . Keyes will vary its formulation to fit it to a "T"
- Want impact strength . . . unusual dielectric properties . . . resistance to water absorption, warping, abrasion?
- Keyes Research Staff will study . . . carefully determine the properties most important for the use intended . . . then whip up the proper grade of Kys-ite to give the best results.
- In short, with Kys-ite you get custom work with custom made material in exactly the form you need . . . finished product or component parts molded to your specifications.
- Like a sample chip of this amazing plastic and a properties sheet? Mail the coupon NOW.

Dept. L2

KEYES FIBRE CO., 420 Lexington Ave., N. Y. 17, N. Y.

Please tell me how you can supply us with stronger compression molded parts——send sample chip——

NAME _____ DEPT. _____

COMPANY _____

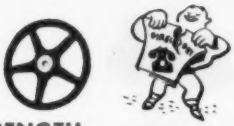
ADDRESS _____

CITY _____ ZONE _____ STATE _____

OUR PROBLEM IS _____

KYS-ITE

The Plastic that Has Everything



STRENGTH . . . Withstands extreme torque. No weakening stresses or strains set up by incorporating metal hub inserts in this Kys-ite Valve Wheel.

BEAUTY LIGHTNESS . . . Glamorous appearance, lasting lustrous finish, a featherweight to handle . . . attractive durable, convenient . . . this Tableware is Kys-ite.

VERSATILITY . . . Unusual length . . . over 5 feet . . . something of a record for high compression molding in hardened steel dies. This Window Sill Track is Kys-ite.

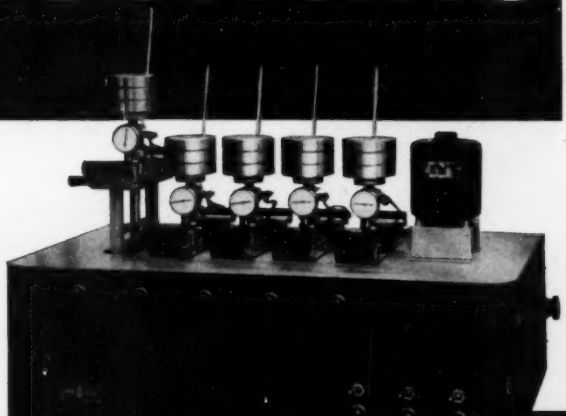
CLEANABILITY . . . Easy to wash . . . retains lustre even with boiling water or dishwashing compounds. This High Chair Tray is Kys-ite.

ADAPTABILITY . Varying thickness of Kys-ite with permanent metal inserts make this General Electric portable radio cover assembly strong, tough, durable.

DURABILITY . . . Kys-ite's remarkable resistance to chipping, cracking, denting . . . make it an ideal replacement for metal as in this Kys-ite Roller.

KEYES MOLDED PRODUCTS

ANNOUNCING



THE NEW OLSEN
5 GANG HEAT DISTORTION TESTER
(Meets ASTM Spec D-648)

A test unit removed—showing the simplicity of construction, and ease with which the technician is able to work with the equipment.

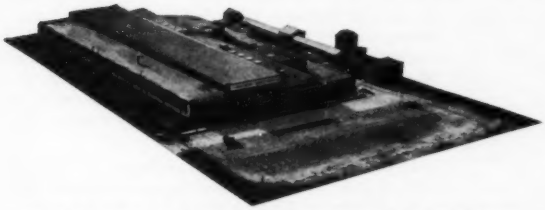
To meet the increasing demand by the Plastics Industry, Tinius Olsen Testing Machine Company has developed the new 5 gang heat distortion machine which provides for 5 tests to be made simultaneously on the same or different materials.

Each of the 5 units is complete within itself—with automatic deformation indicator, thermometer, pilot light, automatic heating controls and cooling system to speed testing. The automatic heating controls raise the temperature 2°C per minute from 25°C to 200°C.

Each of the 5 units will accommodate all specimens from ⅛" x ½" to ½" x ½" under fibre stress of 66 psi or 264 psi.

Great convenience of inserting the specimen has been built into the design of the test units—each is held in place by positive spring clips which may be released for the unit to be lifted. (See left hand unit in illustration above.)

Write today for complete information.



We will be glad to show you our new plant on Easton Road, Willow Grove, Pa. (Suburb of Phila.). Over 100,000 square feet of area all on one floor devoted exclusively to the manufacture of testing and balancing equipment.

TINIUS OLSEN

Testing & Balancing Machines

TINIUS OLSEN
TESTING MACHINE CO.
2050 Easton Rd., Willow Grove, Pa.

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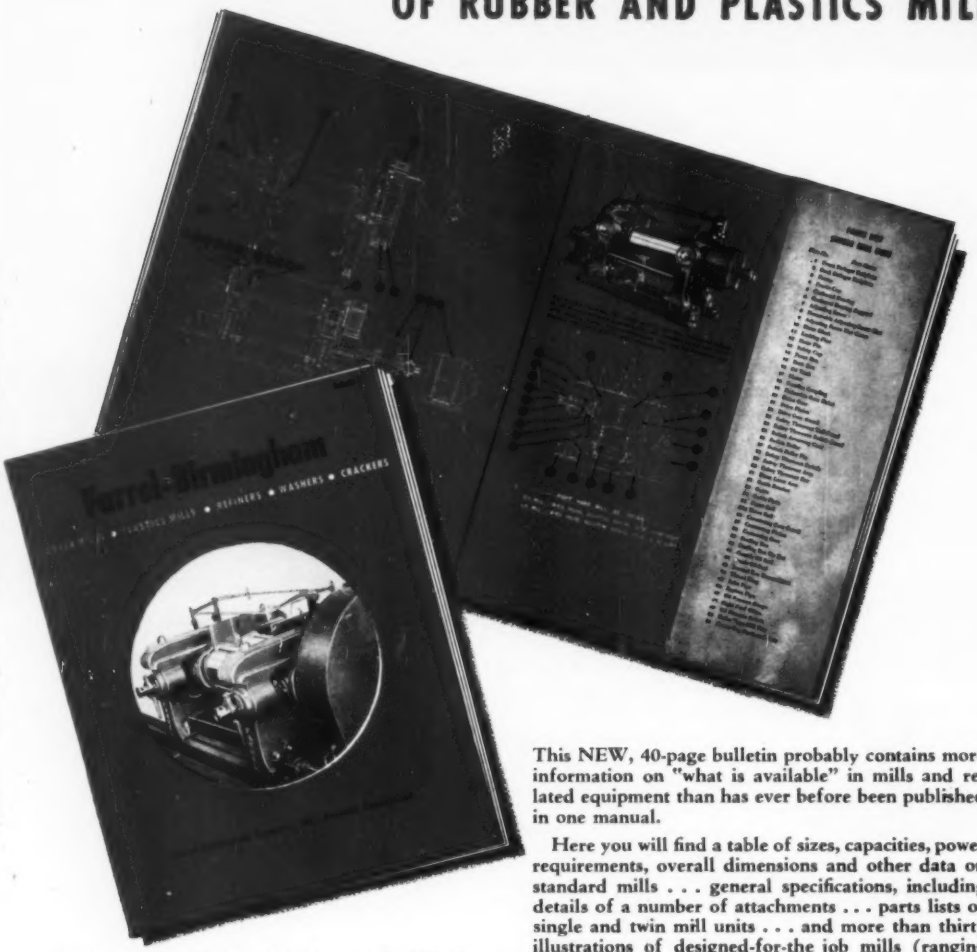
COMPLETE ENCYCLOPEDIA
OF RUBBER AND PLASTICS MILLS



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MP-2

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This NEW, 40-page bulletin probably contains more information on "what is available" in mills and related equipment than has ever before been published in one manual.

Here you will find a table of sizes, capacities, power requirements, overall dimensions and other data on standard mills . . . general specifications, including details of a number of attachments . . . parts lists of single and twin mill units . . . and more than thirty illustrations of designed-for-the job mills (ranging from 6″ to 28″ in size), complete with descriptions of the special features of each. Also illustrated are refiners, washers and crackers, as well as other F-B processing units. The Farrel-Birmingham process-testing laboratory, where manufacturers are invited to explore the possibilities of new processing techniques, and the company's specialized engineering service are described.

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Tri-basic Lead Sulphate. Tribase is the most basic lead sulphate available. It has a total lead content equivalent to 90% PbO, which means it affords maximum reactivity with the degradation products of vinyls caused by heat.

It is the quality stabilizer for vinyl insulation. The electrical characteristics and heat stability of vinyl compounds containing Tribase are unsurpassed!

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Basic Lead Silicate Sulphate. Tribase-E was specifically developed to answer the vinyl electrical insulation industry's demand for a stabilizer with exceptional heat stability and good electrical characteristics at low volume cost.

Tribase-E takes advantage of the electrical properties of lead silicates without sacrificing moisture repellency. The safe reactive lead content, together with the absence of any carbonate, eliminates danger of gassing.

TRADE NAME	CHEMICAL COMPOSITION	RECOMMENDED FOR USE IN
"Dutch Boy" Tribase	Tri-basic Lead Sulphate	Electrical compounds
"Dutch Boy" Tribase E	Basic Lead Silicate Sulphate Complex	Low volume cost insulation
"Dutch Boy" DS-207	Di-basic Lead Stearate	Sheeting, extrusion and molded compounds, i.e., insulated wire and vinyl phonograph records
"Dutch Boy" Plumb-O-Sil A	Co-precipitate of Lead Orthosilicate and Silica Gel	Translucent and colored sheeting and upholstery stocks
"Dutch Boy" Plumb-O-Sil B	Co-precipitate of Lead Orthosilicate and Silica Gel	Translucent film and sheeting, belting
"Dutch Boy" Plumb-O-Sil B Electrical Grade	Co-precipitate of Lead Orthosilicate and Silica Gel	Highgrade insulated wire and sheeting
"Dutch Boy" Dythal	Di-basic Lead Phthalate	General purpose stabilizer for heat and light
"Dutch Boy" Dyphos	Di-basic Lead Phosphite	Excellent for heat and light in all opaque stocks including Plastisols and Organosols
"Dutch Boy" Normasal	Normal Lead Salicylate	Vinyl flooring compounds. Rubber stocks as non-scorch activator

"DUTCH BOY" DS-207

Di-basic Lead Stearate. When used with Tribase or Tribase-E, DS-207 improves processing characteristics, water repellent properties and light stability of your vinyl insulation stocks. DS-207 has a double utility when used in Vinyl Plastics. It is an excellent heat and light stabilizer; it is an effective lubricant.

"Dutch Boy" Stabilizers—Tribase, Tribase-E, DS-207—impart excellent electrical properties, improved resistance to moisture, increased stability to heat and light aging.

They have maximum reactive lead content; they are widely compatible with other compound ingredients; they're economical.

And—like all "Dutch Boy" products—they're backed up by the solid reputation of the maker—National Lead Company.

Our technical staff will be glad to help you stabilize vinyl resins for any use. Write for complete information.

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SO REAL THEY REACH FOR THE BOTTLE

These displays for Miller High Life Beer have been extremely successful in winning new customers at the point of sale. Molder: Anfinsen Plastic Molding, Inc., Aurora, Ill. Display maker: Thomas A. Schutz Co., Chicago, Ill.

—but it's KOPPERS POLYSTYRENE

▼ Many a man has been tempted to reach for the bottle in this effective display for Miller High Life Beer . . . but the bottle, the ice and the bucket are all made from Koppers Polystyrene.

The back of the transparent bottle is sprayed with a pale amber color exactly the shade of the beer. Real labels are pasted on and the top is gilded.

The bucket looks like aluminum, but once again it's crystal polystyrene sprayed with metallic paint, however, the lettering is transparent, permitting vari-colored light to shine through.

Even the ice is transparent polystyrene, molded in a specially-finished mold which gives the realistic effect.

This display shows the variety of effects you can get with Koppers Transparent Polystyrene and the small display uses an eye-catching red polystyrene to get its share of attention.

A number of factors led to the choice of Koppers Polystyrene, but the main ones were these —

- **LOW COST**—Huge quantities of these displays were needed, so Koppers Polystyrene 3 was used to produce more finished pieces per pound and more per dollar.
- **EASY MOLDING**—Koppers Polystyrene 3 is easy to mold and easy to release from the mold—factors that resulted in more pieces per hour.
- **VERSATILITY**—The three main parts of the display—bottle, ice and bucket are all made from one plastic.
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Plastics Division

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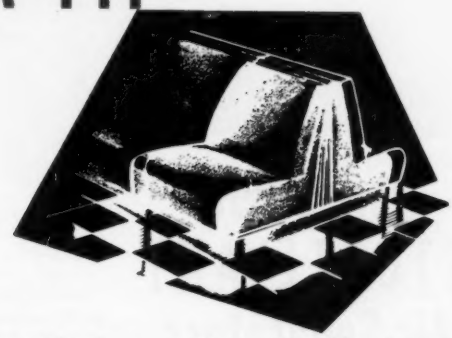

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Name the *special* quality you want in your polyvinyl chloride film. Then have a look at Santicizer 141 . . . one of the family of Monsanto Plasticizers . . . and see how easy it is to get that quality . . . tailor-made to your needs and with economy that favors your cost figures.

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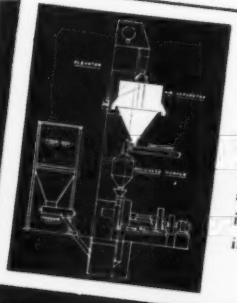

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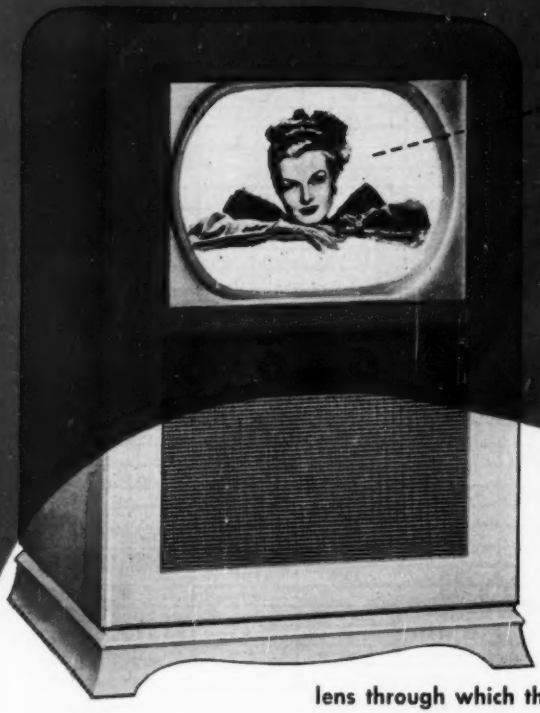

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Facts You Want About EMERY Plasticizers!

PERFORMANCE DATA OF EMERY PLASTICIZERS

40 Parts Plasticizer; 60 Parts Geon 101;	Plastolein 9058 di-2-ethyl hexyl azelate	Plastolein 9050 di-2-ethyl butyl azelate	Plastolein 9055 diethylene glycol dipelargonate	Plastolein 9250 tetrahydro-furfuryl oleate	Plastolein 9715 resinous type	Plastolein X960R resinous type
75 mil film						
Low temp. flex. (-30°C.)	Exc.	Exc.	Exc.	Exc.	Good	Fair
Low temp. flex. (-40°C.)	Exc.	Exc.	Exc.	Exc.	Poor	Poor
Modulus @ 100% Elongation	665	620	620	700	1013	873
Tensile	1628	1570	1472	1680	1977	1940
% Elongation	347	380	319	350	275	297
Hardness (Durometer "B")	50	45	53	61	58	60
Volatility (24 Hrs. @ 105°C.)	1.2%	6.6%	5.9%	3.5%	0.9%	0.4%
10 mil film						
Oil Extraction* (24 Hrs. @ Rm.T)	21.2%	—	18.8%	16.3%	3.05%	3.15%
Water Extraction (24 Hrs. @ 60°C.	0	0.8%	3.6%	2.6%	6.3%	1.0%
Roll Spew * Atreol #9	None	None	Moderate	Severe	Moderate	None

SPECIFICATIONS AND CHARACTERISTICS OF EMERY PLASTICIZERS

Acid Number (Max.)	1.0	1.0	2.0	2.0	5.0	5.0
Boiling Point @ 5mm	237°C	230°C	229°C	240°C	N. Dist.	N. Dist.
Cloud Point	-39°C	-40°C	-15°C	-30°C	-17°C	-25°C
Color (Gardner)	—	—	3 Max.	2 Max.	7 max.	7 max.
Color (Lovibond 5¼" cell)	1.6/0.4	0.5/0.2	60/3	7.0/2.4	—	—
Color (Transmission)**	88/99	98/99	/90	60/93	—	—
Fire Point	—	430°F	453°F	445°F	595°F	560°F
Flash Point	400°F	365°F	410°F	415°F	530°F	500°F
Freeze Point	-39°C	-40°C	-15°C	-30°C	—	—
Hydroxyl Value (Max.)	4.0	4.0	11.0	—	15	15
Molecular Weight (Average)	412	356	362	366	—	—
Refractive Index @ 25°C.	1.4477	1.4445	1.4463	1.4635	1.4629	1.4574
Specific Gravity (20°/20°)	0.9184	0.934	0.966	0.9278	1.075	1.031
Viscosity (poises @ 25°C.)	—	—	—	—	4	2 to 3
Viscosity @ 100°F. (SUV)	81.3	52.1	79.8	62.5	—	—
Viscous Point	—	—	—	—	-25°C	-25°C
Volatility (1⅛ Hrs. @ 370°F.)	—	—	—	—	5.0%	1.7%
Volatility (5 Hrs. @ 105°C.)	1.05%	1.6%	1.6%	1.0%	0.8%	0.5%
Weight Per Gallon @ 20°C.	7.65 lbs.	7.78 lbs.	8.05 lbs.	7.73 lbs.	9.0 lbs.	8.72 lbs.

** Transmission colors expressed as percent light transmitted @ 440 mmu/550 mmu on Coleman Junior Spectrophotometer (2.5cm Cuvettes)

COMPATIBILITY OF EMERY PLASTICIZERS

All Emery Plastolein Plasticizers are compatible with Polyvinyl Chloride, vinyl acetate—chloride copolymers, nitrocellulose, ethyl cellulose and cellulose acetate-butyrate. (With polyvinyl acetate, 9715 and X960R are compatible, the other Emery Plasticizers have a limited compatibility in this resin.) With polyvinyl butyral only Plastolein 9055 is completely compatible although both 9715 and X960R have a limited compatibility. Except for 9250, all Emery Plasticizers are recommended for Acrylonitrile-Butadiene Rubbers and Styrene-Butadiene Copolymers.

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MODERN PLASTICS

VOLUME 27 FEBRUARY 1950 NUMBER 6

Plastics Industry Trends

1949 use increased 18% over 1948. Big-volume consumer goods production calls for new type of salesmanship

TOTAL consumption of all synthetic and cellulosic compounds by the plastics industry has increased more than 50% since 1946, the year when commercial application became free after the war and, incidentally, the first year in which detailed records became available to the public. Figures given in Table I are based largely on compounds rather than raw resin, since the filler is an essential part of the formulation. There has been considerable juggling of figures in the past four years in an effort to find the form of tabulation that would be most practical. The reader is consequently cautioned to use all comparisons with care.

In 1949 sales figures were published for the first time. For practical purposes they can be used in measuring 1949's output against consumption figures in former years. The urea and melamine molding material figure has always been included in "Miscellaneous" until 1949. Now it is listed under "Urea and Melamine." In "Miscellaneous —other uses," the 1949 figure includes nearly 70 million lb. of coumarone indene and petroleum resins. An estimated 80% of coumarone indene is used in asphalt flooring of the light-colored grades and most of the balance in the paint, varnish, and lacquer business.

The plastics industry as we define it, exclusive of the paint business, used about 18%, or somewhere near 168 million lb., more compound in 1949 than in 1948, exclusive of coumarone indene.

Highlights of 1949 were the growth of polystyrene and styrene derivatives; the progress of the vinyls; the

Table 1 — Plastic Materials Consumption in Pounds [a]

	1946 Consumption & Shipments	1949 Sales
Cellulose acetate and cellulose acetate butyrate	103,000,000	76,000,000
Nitrocellulose plastics	18,100,000	7,100,000
Other cellulosics	12,100,000	8,000,000
Phenolics	242,300,000	232,100,000
Urea and melamine [b]	58,200,000	112,000,000
Styrene & styrene derivative polymers & copolymers	66,800,000	203,000,000
Vinyl compounds [c]	167,000,000	360,000,000
Miscellaneous molding [d]	50,000,000	39,000,000
Miscellaneous for other purposes, except protective coatings	35,700,000	152,000,000 [e]
TOTALS	753,200,000	1,189,200,000

[a] Includes filler for all molding, extrusion, film and sheeting materials. Other items such as adhesives and laminating varnish based on solid resin only. No protective coatings included except a small amount of vinyl.

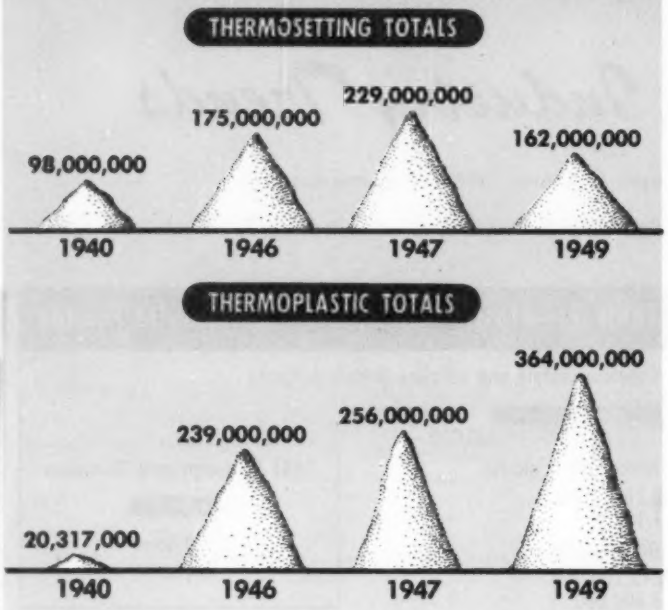
[b] Urea and melamine molding powder was included in miscellaneous molding materials until 1949 when it was moved into the figures classified under "urea."

[c] Includes vinyl chloride, butyral, acetate, formal, alcohol, vinylidene chloride compounds.

[d] Includes acrylic, polyethylene, nylon, and other miscellaneous materials. No casein included.

[e] This 1949 figure includes acrylic sheet, alkyd, coumarone indene, petroleum, silicone and other miscellaneous. About 70,000,000 lb. of it is coumarone indene and petroleum resins which were not included in the 1946 figures.

Table 2 — Production of Molding and Extrusion Materials [a] in Pounds, 1940 through 1947 Compared to Sales in 1949



	1940	1946	1947	1949
Phenolic	80,000,000	140,000,000	194,000,000	120,000,000
Urea and melamine	18,000,000	35,000,000	35,000,000	42,000,000
Thermosetting Totals	98,000,000	175,000,000	229,000,000	162,000,000
Acetate and butyrate	16,000,000	83,000,000	59,000,000	57,000,000
Other cellulose plastics	17,000	12,000,000	3,000,000	8,000,000
Polystyrene	1,800,000	67,000,000	95,000,000	178,000,000
Vinyl (includes saran)[b]	1,000,000	62,000,000	73,000,000	82,000,000
Miscellaneous	1,500,000	15,000,000	26,000,000	39,000,000
Thermoplastic totals	20,317,000	239,000,000	256,000,000	364,000,000
GRAND TOTALS	**118,317,000**	**414,000,000**	**485,000,000**	**526,000,000**

[a] Includes filler
[b] These figures vary from Table IV, page 59, since they not only embrace saran and miscellaneous vinyl molding materials other than vinyl chloride, but are also complicated by a vast variety of opinions on the amount of filler used in compounds. Admittedly they are not as accurate as others in this column — they lean to the conservative side — but for the purposes of this chart any error is not sufficient to make an important change in the grand total.
Source — U.S. Census Bureau; U. S. Tariff Commission; MODERN PLASTICS estimates.

return of acetate to its 1947 level although still under 1946; the construction of two new polyethylene plants with a rated capacity of over 55 million lb. although 1949 production was only about 30 million pounds. The phenolics of nearly all types suffered a severe decline in the first half of the year, but were rolling merrily along at a rate not too far below their peak year during the Fall months. Urea and melamine increased slightly due partially to the success of dishware, melamine laminates, and an abundance of urea crystal which had been short in other years.

The industry as a whole followed the general trend of business in 1949 with a gradual decline in the early months and a severe bump in July. But as usual it picked up rapidly in August and—also as usual—sold well over 60% of its total production in the last six months. However, despite the Summer decline, over-all production of plastics raw materials increased in 1949 in comparison with all manufacturing business which suffered about an 8% decline in 1949 from 1948. The plastics industry seems to have developed a permanent pattern of big months in March, April, September, and October but there is still no proof that such a pattern will continue despite other business trends. It is worth pointing out that nearly all economists predict that 1950 will be a year in which the heaviest production will occur in the first six months with a possible leveling off or decline in the latter half. It will be interesting to note whether or not the plastics industry continues its heaviest production from August to December in 1950 if those predictions come true.

Polystyrene and vinyl, the two leading-volume new plastics, followed the general business index by a let-down in the late Spring and early Summer months but were generally far beyond sales for the same periods in 1948. Experts will be watching them closely for the same trends in 1950 to ascertain whether or not they have come anywhere near the saturation point. Producers of these materials think not—both industries are planning for a 15 to 20% increase in 1950 and will be prepared to accept more.

Another far-reaching trend brought about by the big-volume polystyrene and vinyl industries is the production of more consumer goods which require a far different type of salesmanship than that used by the old-timers who grew up considering themselves as "parts" manufacturers. Newcomers in the industry have entered this competition with increasing zest and have brought with them sales experience acquired in handling retail and jobber accounts in the fabric, variety store, and chain store fields. But many old veterans in the plastics industry have caught on quickly and don't intend to let the "young fry" get an upper hand. The merchandising stew in the plastics industry is just beginning to bubble. As the president of Marshall Field told the industry at the Spring S. P. I. meeting, "The more you make—the more difficult it is to sell."

Materials Supply and Demand

Phenolics

THE phenolic branch of the plastics river cut a tortuous channel through 1949. Sand bars, shallows, and rocks, which some veterans in the industry had never expected to see again, put in an appearance. Beginning in August, however, the industry began to pick up volume. Resin facilities that had been closed down were re-opened; old molds were taken out of storage for reuse; tool rooms started clattering; and presses began that rhythmic clomping which never fails to put sparkle in the eyes of production men. One substantial customer is reported to have bought 50 times more molding compound during this period than during the low months early in the year.

The decline in phenolics, particularly in molding powder, began as far back as October 1948, when production of molding material fell to 13,700,000 lb. after a healthy 16,200,000 lb. in September. The record output for the industry—19,715,000 lb.—had been attained in March of that year, and surprisingly high figures were maintained all through that Summer. The decline in October 1948 was an ominous portent of what was to follow, for an almost steady monthly decline set in until a low of around five million lb. was recorded in July 1949.

By that time, many thermosetting molders felt like locking their doors for keeps. Their rate of consumption of molding powder was less than the pre-war rate; yet they had facilities—and the accompanying overhead—to handle many times their pre-war capacity. A drop from 20 million lb. in March 1948 to 5 million lb. in July 1949 was indeed disheartening. Smart leaders in the industry had predicted that a decline was to be expected, but we know of no one who was pessimistic enough to forecast its severity.

Then the miracle happened. The industry bounced back like Joe Louis rebounding from an opponent's blow. Consumption and sales zoomed up to around 15 million lb. monthly during the late fall. There was some inclination to believe that the large sales of molding powder in September and October were influenced by fear that the steel and coal strikes would cut off the supply of benzol and phenol, which are essential to molding powder production. But sales of molding powder by the raw material companies continued at a high level even after the strikes were settled.

Phenolic Capacity

When the steel strike began in September, most phenolic producers had enough raw materials on hand to continue their operations for at least two montns, so they were not immediately affected when benzol production suffered a 70% reduction. The capacity of the industry to produce molding powder is estimated to be at least 25 million lb. monthly when raw materials are in free supply. There is little likelihood that that amount will be consumed in the immediate future, but there is always a possibility that phenolic raw materials supplies may be curtailed if steel or coal production is paralyzed by strike action.

A chart of the phenol-formaldehyde molding industry since the war probably has more peaks and valleys than any division of the plastics industry; yet it is the second oldest of all branches. It grew from a 2,500,000 lb. annual production in the 1920's to 80 million lb. in 1940, to almost 200 million lb. in 1947, then dropped to 120 million lb. in 1949. The drop in 1949 is discouraging, but not disheartening.

Now that the 1949 scare is over, it is worthwhile examining the situation in a less panicky state of mind and reviewing what has been going on. There seems little doubt that the big sales in 1947 were based on an artificial or at least temporary demand. Astute veterans in the industry warned molders time after time that they were living in a false paradise—that the market for iron handles, radio cabinets, electrical fixtures, etc., was becoming saturated. They pointed out that the molders and other processors must find new ideas, new products, and new markets.

Large Molded Pieces

The first and most obvious new outlet was in larger pieces. Progress has been made along this line but it is slow. The amount of resin going into the newer large pieces is still a very small percentage of the whole. Television cabinets are the most widely publicized of the new big pieces, but of the nearly 2,750,000 television sets produced in 1949, only a relatively small number have phenolic cabinets—not nearly so big a percentage as the plastics molding industry hopes to capture within the next five years.

Older big pieces, such as electrical switch gear and slide frames for

Table III—Sales Report for Phenolic and Other Tar Acid Rasins[a]

	1946	1947	1948	1949[b]
Laminating (dry basis)	27,000,000	40,546,186	43,000,000	40,000,000[c]
Adhesives	16,100,000	21,000,000	20,700,000	24,100,000
Molding materials	140,200,000	194,000,000	171,000,000	120,000,000
Misc. uses, including casting	58,200,000	63,400,000	61,400,000	48,000,000
Total	242,200,000	318,946,186	296,100,000	232,100,000

[a] Figures are for consumption plus shipments in all years except 1949. The latter is a sales figure.
[b] Last two months estimated.
[c] Production rather than sales figures are used for laminating resins in 1949 since in this particular instance they give a more accurate picture of transacted business.
Source: Figures based on U. S. Bureau of Census and U. S. Tariff Commission reports.

windows, have not yet shown great growth. The latter especially is expected to increase eventually—there seems little reason why the now generally accepted use of phenolic slides in showcases can't be applied more frequently to home windows. Dresser drawers and other furniture parts did not come to the forefront as expected, but resin producers are counting on a sure and growing market in this field in the years to come—if for no other reason than a scarcity of suitable wood. Mechanical and cost problems will be overcome as experience is gained.

The effort that the phenolic industry must make to get into larger pieces and other new fields comes as a mild shock to many operators who experienced such phenomenally good war and post-war business that they had no time to plan for the future. Customers clamored for products, and molders clamored for molding powder. The radio industry illustrates the situation. Some 20 million sets were turned out in 1947—everybody wanted them. Millions of pounds of phenolic were converted to house these sets in 1946, '47, and '48. In 1949 there will be less than 10 million radio sets produced. The 2,750,000 television sets made in 1949 weren't nearly enough to fill the gap created by the 50% drop in radio cabinets, but eventually television will mean more to phenolics than radio ever did.

Inventories Piled Up

The same story can be repeated in several instances. Electrical fixtures is one. Housing and housing repair showed great prospects in 1947 and 1948—inventories of electrical supplies were built sky high. The housing program faltered and is just beginning to move again. The inventories piled up here have started to liquidate. The number of housing units started in 1949 broke the 1925 record of 937,000, which means more possibilities for switch plates, circuit breakers, plugs, etc.

Electric iron handles is another example. The 1945 and '46 demand was unbelieveable. Plastics had already proved their worth and molds were on hand. In addition, an OPA policy prevented price raises on the old styles. Manufacturers, therefore, altered styles. A fancy new phenolic handle was part of the new style, and the OPA restriction on price wasn't applied to the new job. Iron handles came out of the presses like chicks from an incubator on hatching day. And therein lies a story for phenolics. Samples of phenolic handles were first introduced in 1926, but no one would use them. They didn't catch on until the late 30's. The total poundage consumed in pre-war days seldom, if ever, exceeded 40,000 lb. in one month. Since the war there have been many months when poundage ran from 300,000 to 400,000 pounds. And, believe it or not, last August was one of those big months despite the fear that there were enough handles molded to last for years and that there had been an almost totally blank market for previous months in 1949.

All of these examples point to several conclusions:

1) The 1947-'48 boom in phenolics was partially stimulated by scarcity of other materials and partly by a starved populace which had been cut off from supplies for four or five years.

2) Excessive inventories of phenolic parts were in storage. When supplies of all materials began to come into balance—when customers slowed up in their post-war buying orgy—the manufacturers of radios, electric irons and fixtures, pans, etc., quit buying from molders. They all needed cash due to the general economic condition of the country; hence they attempted to cut inventories and build up their cash positions as soon as possible.

3) When general business continued fairly good in 1949 despite fears of business men that it was slipping, these inventories suddenly ran too low. Starting in August, molders began getting sizeable orders from their old customers again and surprised the phenolic producers with their increased demands for molding powders. Said one chemical company executive in September: "Monday I was highly praised by management for reducing our inventory—Wednesday I caught hell for being such a fool."

4) Many years are generally required before a phenolic product becomes universally adopted. Note iron handles, pan handles, washing machine agitators, etc.

5) The improved Fall business was good, solid stuff; no flash in the pan. This indicates that the phenolic molding industry is not likely to enter a permanent decline, which many feared. Nevertheless, new orders were a long distance from meeting the industry's capacity to produce—perhaps not even enough to make reasonable profits because of increased overhead grown up with increased facilities. The normal population growth cannot be depended upon to account for enough increased demand for phenolics. Industry must seek ever-broadening markets, improved production techniques, bigger volume in many present items, and new fields in items never before made in molded phenolic.

Glamorized Phenolics

To meet the requirements for selling a bigger volume of phenolic merchandise, the industry will probably have to "dress up" its product. It's not impossible to glamorize phenolics; for example, black pheno-

(*Continued on page* 129)

Vinyl

WHEN Pearl Harbor was attacked on Dec. 7, 1941, vinyl resin wasn't much more than an ink splash on the pages of plastics history. Production was little over one million lb. a year. Eight years later, compounds of vinyl chloride and vinyl chloride copolymer resin led all other plastics production with a 1949 volume in the neighborhood of 300 million lb. or 150,000 tons.

This 300 million lb. figure includes some 100 million lb. of plasticizer and filler, but they are an integral part of the compound just as they are an integral part of acetate, phenolic, and amino compounds.

Table IV includes only polyvinyl chloride and vinyl chloride copolymer materials. By contrast, the Tariff Commission's monthly report includes polyvinyl butyral, formal, acetate, and alcohol as well as vinylidene chloride (saran). All of the last named vinyls make up a total production of approximately 60 million lb., but since the com-

Table IV—Consumption in Pounds of Polyvinyl Chloride and Copolymers Only, 1947-1949

	1947		1948		1949	
	Resin only	*Total poundage with filler*	*Resin only*	*Total poundage with filler*	*Resin only*	*Total poundage with filler*
Film (under 10 mils)	18,000,000	27,000,000	29,000,000	44,000,000	53,000,000	85,000,000
Sheeting (over 10 mils)	22,000,000	34,000,000	26,000,000	40,000,000	30,000,000	54,000,000
Fabric coating	14,000,000	25,000,000	19,000,000	38,000,000	25,000,000	54,000,000[a]
Paper treatment	3,000,000	4,600,000	2,500,000	3,800,000	5,000,000	7,500,000
Molding and extrusion	30,000,000	45,000,000	38,000,000	68,000,000	38,000,000	68,000,000
All other, including protective and surface coatings	12,000,000	15,000,000	20,000,000	24,000,000	29,000,000	40,000,000
Totals	99,000,000	150,600,000	134,500,000	217,800,000	180,000,000	308,500,000

[a] This figure includes both calender coated and spread coated materials with resin content varying from 40 to 55%.

pounds based on chlorides form such an overwhelming part of the total vinyl production, an attempt has been made here to separate them from the smaller volume materials in the interest of clarity.

Every precaution has been taken to make these figures as accurate as possible and it is reasonably certain that the total is accurate within a 5% range. There will be some analysts, however, who will contend that the breakdown of the various categories is off from 10 to 15% in some cases. There are many different ways of reporting and estimating; producing companies sometimes differ in their classifications. As a result, there probably never will be an analysis accurate down to the last pound.

Resin Production

Capacity for resin alone is believed to be more than 280 million lb., with some 80% in the hands of Bakelite Corp. and B. F. Goodrich Chemical Co. Monsanto Chemical Co., Goodyear Tire & Rubber Co., and Firestone Tire & Rubber Co., now have plants in operation estimated to be capable of producing annually from 8 to 15 million lb. each. The Glenn L. Martin Co. plant at Painesville, Ohio, recently sold to U. S. Rubber Co., has an announced capacity of 25 million pounds. There is reported to be a move on foot to encourage more imports of British resin, where current capacity for production of resin is reported as 18 million lb., with an expansion plan calling for 18 million lb. more in 1950.

All through the year, the total of vinyl sales ran consistently above 1948 monthly sales with the three months of May, June, and July showing the lowest totals and the Fall months indicating big increases. August led all other months of the year up to that time, but the pace continued at an even greater tempo into the Fall months. Beginning in September, vinyl resin became so scarce that producers started a mild allocation system.

The biggest outlet for vinyl in 1949—as it was in 1948—was film. This was mostly 4-mils thick, but ranged from 2 to 10, as distinguished from sheeting which is material over 10-mils thick. The sales of film and sheeting ran between 8 and 12 million lb. a month until August when sales began to mount rapidly to a high of about 18 million lb. in October. Every month of the year was far above the same month in 1948, when sales ran from a low of about 5 million lb. in February to around 10 million lb. in October, in comparison to a range of from 10 to 18 million lb. in 1949. Yardage of film during peak months in 1949 was approximately 40 to 50 million. Most of this material, both film and unsupported sheet, is produced on calenders which will turn out 4-mil film at speeds of from 60 to 100 yd. a min., with speed decreasing of course in ratio to the thickness of the film or sheet.

Calenders

From 50 to 60 calenders, which, when set up with all auxiliary equipment require a capital investment of nearly $500,000, have been installed since the end of the war and there are also a large number of converted rubber calenders now at work in vinyl processing plants. In addition, there are three or four plants producing 2-mil cast film which have moved into the industry in applications such as drapes where such thin film can be employed. Thin cast film is more clear than calendered film but difficult to make opaque. The cost is 82 cents per lb. in comparison with prices ranging from 57 to 64 cents a lb. for 4-mil calendered film. But the yardage is doubled so that a square yard of 57-cent, 4-mil calendered film costs 14.25 cents in comparison to 10.25 cents for a square yard of 2-mil cast film.

This whole business of price and thickness kept film producers in a mild state of furor all through the year. Good standard 4-mil calendered film settled down at a 64-cents per lb. level early in the year but many film producers have seen fit to market their film at a lower price.

By the Millions

The production of vinyl drapes and cottage curtains by the millions, frequently at prices ranging from 90 cents to $2.00, has been at least partially responsible for the tendency to try to make a pound of compound cover more surface. These are applications where lightweight material can frequently be used. Probably this thin-film situation will soon clear up in a normal manner when manufacturers and fabricators definitely establish various grades just as they do in textiles. Then a consumer may buy

either low or high grade merchandise, depending upon what she wants.

The raincoat market has already gone through a similar situation. Customers can now buy a very thin garment if they wish, but in 1949 there was a marked tendency to increase thickness of the film for a higher quality item to sell at a higher price. The low-cost thinner raincoat will nevertheless remain on the market for those who want it. It should be pointed out, as another example, that vinyl shower curtains can now be obtained at from $4.00 to $27.00 or more. Eventually the film price battle now going on will be resolved when other vinyl products are divided into different price ranges and producers are forced to choose the field in which they wish to do business.

Aside from the three products named above, the leading vinyl film outlets are table cloths, chair cushions, aprons, nursery items, protective coverings for items all the way from typewriters to autos in transit, butcher aprons, and an increasingly large amount for fabricating into kits for all sorts of toilet, cosmetic, nursery, and other group combinations. Another fast growing field of unpredictable volume is that for inflatable products ranging from toys to mattresses.

Better Printing

Increasing use of vinyl film has been abetted by vastly improved printing and styling. There is no longer any need to fret about ink flaking off. Good designs that simulate fabric texture have taken hold of the public's fancy. Furthermore, there has been a color trend away from the gaudiness of one or two years ago, and the conservative customer has a wider choice of pattern. The use of metallic colors has also broadened out from raincoats to widespread adoption in household goods.

Perhaps the best proof of vinyl film acceptance by the public was the extensive promotion and advertising it received by retailers. Store display space was freely given and scarcely a daily paper can be scanned these days without finding an advertisement on some sort of vinyl product. One of the most interesting displays during the year was a Canadian store-window exhibit showing the comparative effects of rain on vinyl and fabric curtains. In the same exhibit, a youngster splashed ink on a vinyl curtain without producing any damaging effects.

Unsupported sheeting over 10 mils thick remains a leading outlet for vinyl. By far the largest volume of this material is for upholstery. So many restaurants were newly equipped with this material in 1948 that there was some fear the market might be approaching saturation. Not only were there more restaurant seats upholstered in vinyl in 1949, but thousands of yards found application in automotive use, kitchen and dining room chairs, and even in overstuffed furniture. A significant trend was in the development of new patterns to give the idea that this is a distinctively new material in its own right. Another interesting variation is plate polishing over a printed surface.

Rigid Sheeting

Rigid vinyl sheeting, made from a copolymer resin but with a slightly lower percentage of chloride than ordinarily used in chloride-acetate formulations (it's about the same as that used in high fidelity phonograph records), improved its position in 1949 but the market is still comparatively limited. It is furnished in continuous unplanished rolls or planished sheets and is used primarily for transparent measuring instruments, calender cards, and as a protective transparent covering for printed sheets. It is coming into favor in the drafting field for lofting purposes.

Rigid sheeting is not to be confused with the vinyl sheet which has been recently adopted for the back windows of many convertibles. This window material consists of two 20-mil polished elastomeric sheets, specially prepared for optical clarity and adhered together.

Fabric coating by the calendering method increased in almost the same proportion as unsupported sheeting and for the same reasons. There were no particularly significant developments during the year, however, except that technique and material improved generally and the cost of the fabric backing was reduced to aid the cost situation.

The spread-coating-on-fabric section of the industry, on the other hand, was blessed with some of the most far-reaching developments that have come to the vinyl industry since its inception. Some of the finished goods now on the market are as different from the standard stuff of two years ago as walnut is from pine. Increasing use of plastisols and organosols, plus improved processing equipment that can be operated at less cost is largely responsible. The day of solution coating with its expensive solvent recovery system and sometimes hazardous operation is fading out except for special jobs. New embossing technique has also added to the quality and appearance of coated fabrics.

Paste Formulations

Plastisols or vinyl paste are formulations of resin and plasticizer that require no diluent or solvent. Their importance was called to the attention of this magazine's readers as far back as September 1944 in an interview with Major Ed Hobson who had just come back from England bubbling over with enthusiasm about what the English were doing with them. Pastes can be used for slush molding and various other purposes, but so far have been used primarily in this country for coating. They can be applied in any reasonable thickness in only one pass through the machine and give a peculiarly soft hand and drape to the finished product. Thus the coated material is highly desirable for upholstery, hand bags, women's shoe uppers, and numerous other uses.

Organosols too are a resin and plasticizer formulation, but require a diluent that acts as a solvent. However, the diluent is a low cost material like kerosene or xylol, and so does not require a recovery system. By and large they are used for about the same coating jobs as plastisols. The choice is up to the processor who learns by experience which one he wants when specific properties in the finished product are desired.

The advent of these compounds has brought important changes in processing equipment. Since the new compounds require higher heat for fusing, most of the old coating equipment has been altered by the

addition of new heating units which can apply the extra heat in a jiffy; new ovens and spreaders that give far better heat control and uniform coating weight than ever before attained are moving into the industry; take-off and lead-in methods far different from the old hand-brake system are being employed.

Heavier Coatings

One of the principal results of all these changes has been the development of unusual qualities in coated fabrics. In past years the fabric was generally heavier than the coating. That is, an over-all 30-mil material might have been 20-mil fabric and 10-mil coating—today it may be 6-mil fabric and 24-mil coating. The result is a product that has the hand and drape of an unsupported sheet and the added strength that a fabric backing will contribute.

Akin to this development is the possible growth within a few years of far more spread coating on thin fabric—nylon, silk, rayon, etc. Such things as umbrellas, rain coats, window shades, drapes, tablecloths, etc., seem ideally suited for such experimentation. One company has already done a fine job along this line with baby pants. The famous vinyl-coated nylon army poncho is another example. Producers now claim that the fabric backing makes such products too expensive for competition with free film. There seems reason to believe, however, that thin-coated materials with their possibilities for high grade styling may eventually establish a high quality line of their own that will broaden the coated-fabric market to a considerable extent.

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Polystyrene

THE polystyrene situation in 1949 exceeded the expectations of its most optimistic enthusiasts. Galloping along like Coaltown on his way to a record, polystyrene molding powder sales raced from 66 million lb. in 1946 to nearly 180 million lb. in 1949. Even more significant is the nearly 20 million lb. monthly sales figure that the material reached in some of the later months of 1949.

There is some question as to whether or not the industry could maintain that pace over a year's time without considerable strain, but even the most optimistic forecasters doubt that there will be any such demand in 1950. They do expect that the demand may go a bit over 200 million lb. in 1950 and will continue to increase for some years to come. Estimators believe that present capacity for producing polystyrene molding and extrusion material exceeds 250 million lb. a year, but all conditions would have to remain ideal throughout a whole year for any such amount to be produced; and, as mentioned above, it seems incredible to believe that any such demand will exist before late 1951.

Growth in Miscellaneous

However, there is a side issue developing that could add considerable poundage to over-all styrene plastics production. That is in the category called "miscellaneous uses" (Table V) which has been separated from polystyrene molding material production figures for the first time in 1949. The biggest portion of this 25 million lb. figure in 1949 was in high-styrene-butadiene copolymers and various related compounds such as Plexene and Royalite. The high-styrene-butadiene copolymers are used for shoe soles, floor coverings, etc. (exclusive of protective coatings), but there is also an inestimatable amount of polystyrene emulsion and other modified polymeric formulations in this figure that will grow into sizeable quantity during the next few years.

Styrene monomer is currently in plentiful supply although there was a close squeak near the end of the steel strike last Fall when benzol supplies were almost completely depleted. This benzol and styrene monomer situation will remain unclarified until the synthetic rubber production pattern is more definitely determined. The rubber industry used some 175 million lb. of styrene monomer in 1949 out of a total 350 million lb. produced. Probably just as much or more will be used in 1950 despite the fact that the Government's demand for compulsory use of synthetic rubber has been reduced from 220,000 tons to 162,000 tons. Furthermore, new uses for styrene monomer are constantly being discovered (water paint is a good example) so that the supply problem for the next few years is a bit cloudy. The limiting factor is benzol, total capacity production of which is not much in excess of 170 million gal. and then only when the steel industry is running at full capacity.

The uses for benzol are so varied and so great that a prolonged upsurge in demand for synthetic rubber, polystyrene, phenol, or several other products of a benzenoid nature could create scarcities of serious dimensions in benzol. But producers are inclined to gamble that such a scarcity won't occur for several years at least—especially if natural rubber remains available. They believe that if there is a proved demand for more benzol, the petroleum companies can start producing it within three months time at a cost of 36¢, in comparison to the present 22¢ for coal-derived benzol. The extra cost can be absorbed without serious damage, and within two years' time, increased production would bring the cost down to the same level as coal-derived benzol, according to the calculators. As an example, producers point out that although the price of benzol has recently gone up two cents and monomer may follow, there will be no increase in polystyrene because of techological improvement made in polymerization technique.

Molded Products

The principal outlets of polystyrene molded products remain about the same as they were a year ago: housewares, refrigerator and other industrial parts, and toys.

Housewares include mostly items for the kitchen, bathroom, and general utility use such as flower pots. Dishware, bowls, refrigerator dishes, tumblers, and clothes pins are the leading products in this classification and will probably increase in volume as experience is gained in design and technique. Among the brightest items in this line that attracted attention last year was colored stemware. Increasing volume in refrigerator dishes, often in com-

Table V—Sales report for Styrene and Styrene Derivative Polymer and Copolymer Resins[a]

	1946	1947	1948	1949[b]
Molding materials	68,800,000	95,000,000	145,300,000	178,000,000
Misc. uses, inc. styrene copolymers	.....	.....	.....	25,000,000
Total				203,000,000

[a]Figures are for consumption plus shipments in all years except 1949. The latter is a sales figure.
[b]Last 3 mos. estimated.
Source: U. S. Dept. of Census and Tariff Comm.

bination with polyethylene was noticeable.

The industry was careful to promote polystyrene dishware for exactly what it was—a low-cost item that would give good value for the use intended. No buyer was led to believe that it was a replacement for higher-priced china ware; it was sold as expendable merchandise for picnics or other temporary purposes. The supply companies' national advertising and promotion campaigns in 1949, concentrated largely on housewares, are conceded to have been one of the most important moves ever made by the plastics industry in acquainting the general public with molded plastics products.

Close kin to the housewares business are premiums and small novelties. The year 1950 is expected to bring forth a great volume increase in premiums. Selling will probably be more competitive than any year since the war, and premiums are a time-tried, successful sales stimulant. The individual units are small, but their numbers are great—several items molded in 1949 have already consumed several hundred thousand pounds of material each.

Molders like the housewares and premium business because it is noncyclical—keeps their presses operating all through the year—but they are not likely to sneer at the refrigerator parts business even though it is seasonal. Production of refrigerators has declined and may be off a bit more in 1950, but the use of polystyrene for parts continues to increase, with volume per refrigerator now running from 12 to 20 lb. per unit.

Some of the largest injection molders concentrate their efforts almost entirely on refrigerator parts. Other large moldings such as batteries, clock cases and other housings, radio cabinets, masks for television lenses, etc., most of which were introduced in 1948 with great fanfare, are in fair production but haven't made as rapid progress as expected with the exception of television masks where an order of 750,000 lbs. for one job has been reported. Many of these large pieces require special formulations and extra molding care; suppliers and molders have been so busy with standard materials that they simply haven't had the time to devote to special problems. Consequently, it is going to take some time before polystyrene enters some of these fields in the volume expected—but the 58 injection machines of over 20-oz. capacity, purchased in 1949, indicate that large-size polystyrene moldings are definitely on the way.

Incidentally, the famous Nash panel board is no longer in polystyrene, but it was changed simply because of a style trend and not because of any failure. The plastics industry has finally become accustomed to the style trends in the automotive industry and has learned to take those setbacks in stride. Next year plastics in automobiles may be "chic" again. It is expected that the improved polystyrenes which have good aging properties with little crazing or yellowing will be eligible for a good portion of this market in the smaller items such as dials, nameplates, etc., as well as for large pieces.

Toys

Toys have been a leading outlet for polystyrene ever since the material became easily available. However, some molders feel that there may be no great volume increase in this field for the future. They already have a great portion of this market and expect to hold it but concede that there are many toys that should be made from other materials. In addition, it's a feast and famine business—big in the Spring and Fall, but almost nil in other months. The toy industry is attempting to adjust this situation by promoting toys for year-around gifts, but it's difficult to believe that toys can ever be sold in other months at anything near their November and December peak. It is thought that expanded use of polystyrene contributed greatly to the lower cost of toys in 1949 when more units than ever were sold but dollar volume was reported to be off some 10% from 1948.

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Cellulosics

AFTER a year of the miseries in 1948, the acetate industry bounced back in 1949, especially in the last four months, with a remarkably strong showing. The total of approximately 60 million lb. for 1949 did not equal the 80 million-lb. record for 1946, and low sales in the middle of the year tarnished a record that would otherwise have been more encouraging.

Producers are optimistic enough to believe that a good part of the gain made in the Fall of 1949 can be maintained throughout 1950. If general business remains normal, they expect to approach a sales volume in 1950 that will at least be close to the 1946 record. Even though the industry should attain this goal, there will be no let-up in sales, promotional, and development plans for even greater sales volume. Estimators assert that there is capacity to produce nearly 100 million lb. of acetate and butyrate molding powder, and every effort will be made to find markets to employ that capacity.

One of the producers says, that the increased volume sales in late

1949 were due in part to the advent of 30-cent colored acetate which started to become available in rather large quantities in September. The price for virgin, crystal acetate was reduced from 47 cents to 44 cents in November, but there has been considerable activity in a non-translucent colored acetate which sells for 30 cents. This non-translucent compound is made from material that cannot be used for crystal clear nor transparent colored molding material, but it otherwise retains all the properties for which acetate is noted. The color range is somewhat limited, but one company now has available some 22 shades, and that's enough to take care of a wide variety of products. Toys, premiums, novelties, and many houseware products are currently being molded in this material where its toughness is an especially attractive property; furthermore, this type of business builds up large volume.

It is difficult to determine just what effect this development will have on the sales of standard acetate. Fine color matching with thousands of shades to pick from has always been a strong sales point for acetate. Many acetate salesmen are inclined to believe this emphasis on color plus the maximum properties obtainable in top grade acetate will always result in a preponderance of sales for the best acetate.

There is another intriguing angle about the acetate price structure that creates considerable speculation on the part of those who try to chart price trends. The cellulose acetate flake industry was founded on a product formulated largely from low-cost commodities—cotton linters, wood pulp, and alcohol. The plastics part of that industry was horribly handicapped after the war when those same commodities rose to almost unbelievably high prices at the same time that another competitive thermoplastic was coming to market at a very low price. During 1949, industrial alcohol dropped from around 70 cents a gal. to the low twenties and then leveled off in mid-year in the high twenties. Cotton linters dropped from a high of 18 cents to as low as 6½ cents. Wood pulp, too, took a decided drop. Acetone went down a cent or two. Cellulosic plastic manufacturers assert that these cost declines were offset by labor, new construction, and overhead charges, and everyone grants that it takes time for these things to balance out.

Flame-Resistant Acetate

There have been many things going on, other than cost maneuvering, in the acetate industry over the past 12 months which have aided the general position. Flame-resistant material, with acetate's high impact strength, has come into wide usage for vacuum cleaner parts, housings for deodorizers and shavers, etc. Since many electrical appliances having housings of flame-resistant acetate have been passed by the Underwriters' Laboratory, the Christmas tree light and ornament manufacturers have seized upon it as a safe material. Several hundred thousand pounds were used in that capacity last year. A further step in this direction has been the development of a higher heat-resistant acetate which can withstand numerous boilings without undue distortion. It contains less plasticizer than standard acetate and molds at a temperature some 40° lower than high heat-resistant polystyrene. This material will be channeled largely into kitchenware items—cutlery handles in particular have been successfully tested and used.

Another forward move has been the recapture of a good segment of the toy industry where acetate is recommended for toys that require resistance to banging around. Cellulosic doll heads which in times past have used as much as 2 million lb. a year also made a comeback in 1949 due partly to the development of a new lacquer which did not extract the plasticizer. Another growing business is in toilet seats, which producers claim can in some cases be made less costly than in other plastics since they can be molded in thinner sections.

Other Cellulosics

The higher-priced cellulosic molding compounds, butyrate, propionate, and ethyl cellulose, did not show much change in 1949 over 1948. The 8 million lb. figure for "Other cellulose plastics" in Table VI includes from 3 to 4 million lb. of ethyl cellulose. The balance is mostly Valite, a material made from bagasse and containing natural resin. When mixed with from 5 to 10% ethyl cellulose and filler material, Valite is used largely for phonograph records.

Ethyl cellulose molding powder continued to be used in specialty applications such as tool handles, toilet seats, and vacuum cleaner parts, where its toughness, water resistance, and good electrical properties warrant payment of the price. A new ethyl cellulose development toward the end of the year was a

Table VI—Sales Report for Cellulosics[a]

	1946	1947	1948	1949[b]
Cellulose acetate and mixed ester plastics:				
Sheets, continuous:				
Under 0.003 gage	7,600,000	7,200,000	7,800,000	7,000,000
0.003 gage and over	7,500,000	7,800,000	6,900,000	8,000,000
All other sheets, rods and tubes	4,700,000	3,900,000	3,100,000	4,000,000
Molding and extrusion materials	83,000,000	58,500,000	48,500,000	57,000,000
Total	102,800,000	77,400,000	66,300,000	76,000,000
Nitrocellulose:				
Sheets	10,900,000	9,200,000	7,200,000	5,500,000
Rods & tubes	7,200,000	3,700,000	3,100,000	1,600,000
Total	18,100,000	12,900,000	10,300,000	7,100,000
Other cellulose plastics:	12,100,000	3,500,000	9,600,000	8,000,000

[a] Figures are for consumption plus shipments in all years except 1949. The latter is a sales figure.
[b] Last 2 months estimated.
Source: U. S. Dept. of Census and Tariff Comm.

variation produced by altering and increasing the amount of plasticizer commonly used in the molding compound. The new compound gives better surface hardness and can be molded at lower temperature and less pressure while maintaining toughness and dimensional stability. Its specific gravity remains at 1.1, lower than most cellulosics, which means the purchaser gets more volume per pound.

Ethyl cellulose flake, from which the molding powder is produced, is manufactured at the rate of about 12 million lb. a year and shows promise for developing greater uses

(*Continued on page* 140)

Saran

ACCORDING to the producer, saran sales for the current fiscal year are 50% ahead of the year before and the company is using its full capacity to produce. But the end-use pattern is quite different than in 1948 when more than 60% of the saran produced was used for screen cloth.

The biggest use of saran monofilament in 1949 was for woven automobile seat covers. According to a leading weaver, one out of every five seat covers sold today is saran, in comparison to one out of 15 in 1948. In 1950 the industry hopes to sell one saran cover for every two or three made from other material. One of the reasons is a reduced price. Universal saran covers with facing now start at $15.00 and tailored saran covers can be installed at prices as low as $27.00. Improvement has also been made in color and design. There is no longer need to worry about any appreciable amount of fading. In design, plaids are still most popular, but plain colors and checks are available if the weaver desires them.

The extension of woven saran upholstery material to other uses has grown slowly because there had not been enough material available to evaluate its applicability. It is under test as upholstery for seats in buses, railroad cars, original upholstery in passenger autos, public seating for both indoors and outdoors, and home and hotel furniture. In the latter case it is believed an 8-mil monofilament will be more satisfactory than the 10- to 12-mil sizes generally used in public seating. Other uses, many of which are now going through use tests, are as bristles for brushes, in radio grilles, in women's shoe uppers, in narrow webbing for furniture and belts, in tobacco shade cloth and filter cloth, and for mixing with other fibers to use in heavy drapes. Saran Yarns Co., Odenton, Md., is working on a development for very fine saran monofilament that will eventually be used for lighter weight woven goods.

Screen Cloth Still Good

The first great use for saran monofilament, screen cloth, is still going good but did not expand in 1949. As with most new products it has been difficult to obtain public acceptance for a product so different from long-familiar materials. In addition, galvanized screen was reduced in price last year to bring in additional competition. Saran screen cloth is approximately 11 cents a square foot in comparison to galvanized at 8 cents and copper at approximately 15 cents.

An outstanding feature among all plastics materials merchandising last year—and one to be continued into 1950—was a nationwide cooperative advertising and promotion campaign for seat covers and screening. The campaign is based on national advertising but is carried clear through to the point of sale by every medium possible—local papers, car cards, decorative and informative packaging, radio spots, window displays, and listing in local telephone directories.

Well over 90% of all saran is used for monofilament, but there are possibilities for development along other lines. Molded articles such as valves, dippers, etc., for use in chemical plants have been made, but their use is limited. On the other hand piping for use in chemical plants where saran's extremely high chemical resistance is valuable is being installed quite frequently. Metal pipe lined with saran is another variation of the same thing and can frequently be used where ceramic, glass, or rubber-lined tubing has been used in the past or where even they can't be used. Saran is not resistant to caustics but for such things as sulfuric acid it is excellent.

Possibilities for Film

Saran film development has been delayed awaiting the development of packaging machines which can handle it. It is difficult to adhere and is so soft that it does not push easily on the machines built for paper, cellophane, and other packaging materials. Cost, too, is somewhat higher than other films. However, saran has proved successful for packaging cheddar cheese and dried prunes in particular. It now awaits only further testing proofs before it proves its worth for many other fields including meat and poultry packaging where saran is now a component part of the compound used for one of the better known plastic wraps. A kindred material is saran-coated paper called Saracote, used for cap liners. These liners have exceptional chemical resistance and about the lowest water vapor transmission rate to be found in plastics.

Polyethylene

THERE is a young sapling growing in the plastics forest that many persons believe will be the biggest tree in the woods within 10 years time. Named polyethylene (or Polythene by Du Pont), it is still a sprout compared to the towering phenolic, polystyrene, vinyl, or cellulosic varieties, but its growth has been held back by inability to get nourishment. That nourishment is now available; two big new factories have been completed to supply plant food for the tree in the form of molding and extrusion material that should provide plenty of growing strength for at least the next year or so.

Capacity to produce polyethylene is estimated to be over 55 million lb. a year, but it is believed that

not over 31 million lb. were produced in 1949. The two new plants did not come into production until mid-year, and because the previous supply has been limited to around 15 million lb. a year, processors had not set up equipment to take care of the newly available material. Furthermore, technicians who know how to handle it are few in number and limited in experience. Even though polyethylene is now available in free supply, it will take time to develop enough new facilities to absorb the industry's capacity to produce. It probably won't be many years before further expanded capacity becomes necessary, but building a polyethylene plant is a tremendous engineering feat, and it's safe to say that there will be no new capacity in 1950—nor is it likely to be needed.

This versatile plastic is in great demand because of its potentially low cost—now 44¢ a lb. for natural color molding powder and 46¢ for film extrusion powder. Big-scale production is expected to result eventually in lower prices. In addition, it is the lightest in weight of all the popular plastics. Among its advantages are excellent electrical properties, high chemical resistance, toughness, and flexibility at temperatures well below the brittleness points of other plastics. It is now found in a variety of applications ranging from disposable baby bottles and lollipop sticks to heavy jacketing for telephone cable.

Although all the polyethylene available in wartime was used for electrical applications—and that outlet is still one of its largest—the greatest interest today is in the use of polyethylene in thin film of 1- or 2-mil thickness. It is estimated that 10 to 12 million lb. were used for that purpose in 1949. The rate of operation during the Fall was at a pace that would equal 12 to 14 million lb. a year.

Film for Packaging

Practically all polyethylene industry men assert that their greatest interest in the film is from a packaging point of view. They point to the announced 220 million-lb. (soon to be increased by 33 million lb.) capacity for cellophane and indicate that they not only expect to usurp a good part of that market, but plan to go on to much bigger pastures.

The theory seems to be that the packaging field will expand to the point where it can absorb even more cellophane than at present, and great quantities of polyethylene in addition. The acetate, saran, Pliofilm, and ethyl cellulose producers also expect to get their share. Supposedly, prewrapping of fresh fruits and vegetables is only in its infancy and will eventually require hundreds of thousands of pounds of material. There is no universal material that will do the trick, for the various commodities perform differently when under wraps. Thus, acetate seems most adaptable for tomatoes; but so far polyethylene looks most promising for lettuce, and if all the lettuce shipped is to be prepackaged in polyethylene at some distant day, a flock of extruders would be needed to supply the film. Some of the factors in its favor for packaging film are: polyethylene has a low water-vapor-transmission rate; it can be creased, scored or otherwise fabricated without losing those wvt properties; and to a certain degree it permits transmission of carbon dioxide and oxygen gases as well as those organic vapors which produce rancidity.

Food Wrappers

There has been much talk about polyethylene as a wrapper for frozen foods—and it seems ideally suited for the job, primarily because of its low temperature flexibility and translucence; but so far no great volume has gone into this application. It is also noticeable that the spreading tendency for butchers to display their meats in self-service packages has resulted in the use of cellophane rather than polyethylene packages. Polyethylene processors still expect to make a big dent in both of these markets. A big outlet for polyethylene bags continues in the home, where housewives are buying thousands of refrigerator bags at the rate of five for a dollar.

Another interesting packaging application is the use of polyethylene for carbon black destined for use in compounding rubber. In this use, the polyethylene bag can be

Cost of Plastics in Comparison to Other Materials

The price per pound of plastic materials is frequently deceiving to prospective customers because their attention has been focused upon weight rather than volume. Table VII has been drawn up to show the price per cubic inch of plastics in comparison to other materials A quick reading will show that, when measured by this method, plastics compare favorably on a price basis with most other materials. Salesmen may find this chart handy when discussing price structure.

Table VII—Price per cu. in. of Materials[a]

	Price per lb.	*Sp. gr.*	*Price per[b] cu. in.*
Lead	14.5¢	11.35	5.88¢
Zinc	10.0¢	7.0	2.52¢
Cellulose acetate flake #2	47¢	1.3	2.2¢
Melamine—cellulosic industrial	42¢	1.44	2.18¢
Urea molding material, alpha filled	31¢	1.49	1.66¢
Vinyl resin (VYNS)	34¢	1.35	1.65¢
Aluminum	16¢	2.6	1.49¢
Polyethylene	44¢	0.92	1.45¢
Cellulose acetate flake #1	30¢	1.3	1.40¢
Polystyrene—colors (minimum prices)	31.5¢	1.07	1.19¢
Polystyrene—clear " "	25.5¢	1.05	0.96¢
Urea molding material—inexpensive black and brown	17¢	1.49	0.91¢
Phenolic molding material (gen. purpose, black and brown)	17¢	1.36	0.85¢
Steel ($52.00 per ton)	2.31¢	7.9	0.53¢
Lumber @ $100 per M bd. ft.			0.07¢

[a] Figures are basic raw material prices—molding material in granular form, steel in billets, etc.
[b] Spec. gr. x .03605 x price per lb. in ¢ = ¢ per cubic inch.
DATA COURTESY C. A. BLOUNT, BAKELITE CORP.

dumped into the Banbury without affecting the rubber mix in any way. Used to replace protective Holland cloth on rubber camelback, polyethylene film prevents sticking. For metal parts, chemicals, humus, putty, bath crystals, and many other items affected by moisture, polyethylene film is proving to be a most efficient container.

Hot Melt Coating

One of the most significant developments of the past year has been the inauguration of so-called hot-melt coating where a thin film of polyethylene is coated over, extruded onto, or laminated to paper to produce a moisture barrier with additional tensile strength that has proved exceptionally durable for use in multiple wall bags, meat wrappers, and many other uses not yet divulged. There seems to be no fear that such coated paper will compete extensively with straight film, but rather that it will extend the packaging uses for polyethylene materials.

Another use for polyethylene of interest in the packaging field is that for upgrading wax. A small amount will reduce tackiness, help dissipate flakiness, and give sheen or brilliance to a wax coating such as that used on bread wrappers.

Polyethylene film for house furnishings and apparel is not being particularly recommended on a big scale by industry men at present, but there is a suspicion that it will grow big anyway. The old line extruders are concentrating primarily on packaging applications, but the woods are full of new extruders who certainly must be thinking about home furnishings. Two-mil film is a potentially low-cost item, and even though its drape, hand, and elastic recovery may not equal those of other materials, the cost angle is almost certain to result in the eventual production of low-priced polyethylene tablecloths, drapes, and other so-called fabric items.

Just as soon as printing problems are solved and more extruders get going, the cat will be out of the bag. An extreme exploitation of the consumer film market could well result in a bigger demand than the market can supply, and those most interested in the future of this material would probably prefer to see other more natural markets filled up first.

Polyethylene molded articles are expected to increase several fold in 1950. Dishware, especially the kind used in refrigerators, is already in big volume. Blown bottles are in mass production, and injection-molded bottles are now also being made. An estimated 30 million bottles, requiring almost 1,500,000 lb. of material, were produced in 1949. The industry is shooting at 100 million in 1950. The injection-molded type is sometimes produced in two parts with a metal ring placed at the joint. The ring is induction heated to weld together the two sections, leaving the metal completely surrounded with polyethylene. Collapsible tubes for some purposes are also in process but may have limited use because of permeability.

Millions of closures and caps will be made from polyethylene in 1950 because of its flexibility, which, in many cases, permits use of the cap as an atomizer. These closures do not require a liner, which helps cut processing and material costs. One large tooth powder manufacturer has already switched to polyethylene closures for three of his products.

By next Christmas, a great number of polyethylene toys may also be on the market. They won't break, are not brittle, even in thin sections. Another molded item that has been produced in thousands of units is a socket for tubular furniture legs. Its toughness and waxy smoothness make it ideal for the job.

Fillers for Polyethylene

The use of fillers in molded polyethylene to give it more rigidity was discussed in an interesting paper given before the American Chemical Society last September by R. Bostwick and R. H. Carey of Bakelite Corp. They pointed out that such fillers as clay, silica, carbon black, whiting, etc., reduce mold shrinkage and require no change in mold temperature, but naturally result in a material that is less resistant to cracking or breaking than unfilled material.

Electrical uses for polyethylene are still taking a large quantity of the output for such things as insulation in high frequency wiring, coaxial cable spacers, lead-in wires, jacketing for telephone cable, oil burner and neon sign cables, an electrical tape for splicing, and all sorts of similar applications. Polyethylene will always be an important factor in the electrical industry and should continue to increase its volume here. Yet there was one important disappointment last year in telephone cable production, not because polyethylene failed, but because the price of lead used for cable sheathing fell to as low as 12¢ after it had been up in the high twenties.

Problems Still Ahead

The over-all promise for polyethylene is, indeed, excellent, but several important problems are hampering further development. It is interesting to note that probably every one of them will be on the road to solution before 1950 is over. They all apply to film more than to molded products. First, the film is so flexible that present packaging machinery won't handle it easily—it can't be pushed without crinkling. Producers say that machines are under development that will overcome this.

Second is the printing problem. There has been no really satisfactory ink to date. Since polyethylene contains no plasticizer and is unaffected by solvents, there is nothing for the ink to tie to, such as there is in vinyl—it's almost like printing on metal. The problem is to find an ink that won't rub off, that will withstand stretch in the film, that will not get flaky in low temperature, and that has high abrasion resistance. Polyethylene is used for so many different purposes that an ink which will withstand the corresponding multitude of abuses relating to both packaging and consumer film is indeed difficult to formulate. But good news is in the offing, for several companies have produced specimens to indicate that they are at least on the way to a triumph and need only to iron out a few bugs before their product is ready for marketing.

The third problem is one of bonding, adhesion, or welding—call it what you will. The material's finest properties—chemical resistance and electrical properties—are a handicap when it comes to making the stuff stick. However, several heat-sealing methods are now fairly well proved. Electronic sealing is impossible unless the electrodes are

covered with a high-loss material. Conventional heat sealers have been used by employing a slip sheet of cellophane or paper, to prevent the polyethylene from making direct contact with the jaws of the sealer. A coating of Teflon, silicone rubber, or silicone grease over the jaws is also helpful. Band type sealers which convey the films to be sealed between two steel belts to a heating station, where the polyethylene is melted and sealed, and then to a cooling station where the film is released, make a neat, but wide seal.

Impulse sealers for polyethylene are the latest and are reported to be among the most satisfactory. The principle is described in U. S. Patent 2,460,460. The equipment involves a conducting strip heated by a pulse of electrical current to a temperature above 250° F. A thin non-conductor band separates the strip from the jaw. The conducting strip is heated before or during contact with the film, and the current is turned off as soon as the film has melted. Cooling is effected by conducting the heat back into the jaws. When the joint has been cooled to 160° the pressure is released. The cycle may be under ½ sec. for a thickness of 8 mils.

Another method used particularly for thick sheet is a portable gas welder in which the welding gas is directed at the base of a filler rod and at the edge of the sections to be joined. The torch can be heated by either gas or electricity; nitrogen gas is most satisfactory, and rates as high as 20 in. per min. have been attained.

Film and Sheeting Sales

An estimate of the principal plastic films and sheetings sold in the U. S. during 1949, prepared by R. F. Hansen, assistant sales manager, Vinyl Film Dept., Monsanto Chemical Co., is given in Table VIII. Figures are not available for rubber hydrochloride, vinylidene chloride, or acrylic sheeting. The reader will note that there is some discrepancy between these and figures printed elsewhere in this annual report, but there are probably no two estimators who will arrive at exactly the same conclusion from the varying data available.

Table VIII—Sales of Film and Sheeting

Cellulose acetate (all gages)	15,320,000 lb.	@	$ .75/lb.	$ 11,500,000
Cellulose nitrate	5,000,000 lb.	@	1.20/lb.	6,000,000
Vinyl (all gages)	150,000,000 lb.	@	.65/lb.	97,500,000
Cellophane	225,000,000 lb.	@	.49/lb.	110,000,000
Polyethylene	12,000,000 lb.	@	.75/lb.	9,000,000
Total	407,320,000 lb.			$234,000,000

Acrylics

ACRYLICS have always been among the most glamorous of the plastics. Their weathering properties are the highest among the more commonly used thermoplastics and in most other properties they are equal or superior to their sister plastics. Their cost, however, in comparison with most other thermoplastics, has so far delayed any great expansion. The woods have been full of rumors for many years about possible development of a low-cost acrylic-type resin, but no one has brought such a material to market in the U. S., and no such developments seem likely in the near future.

Last year's sales of acrylic molding powder, sheet, and rod stock are estimated to be somewhere between 20 and 25 million lb., with molding powder accounting for less than half the total. Production capacity is rated as well in advance of last year's sales figure but the market has not yet been found to absorb it. The years 1948 and '49 saw considerable improvement in molding powders and even a reduction in prices but there was no gain in over-all volume. As in all other plastics, the Fall months witnessed a considerable increase in poundage sales, and one producer reports a record breaking month, but the middle-of-the-year slumps held down the year's total.

Three Molding Powders

The industry has now developed three types of molding powder with varying properties to use where each is most fitted. First was a higher heat-resistant material with a heat-distortion temperature of approximately 190° F. However, it is a hard-flow material and consequently a bit difficult to mold. Then there is a medium-flow material with a heat-distortion point of 174° F. A soft-flow material introduced in October has a heat-distortion point of 151° F. and a fast molding cycle that can be used where higher temperature resistance is not required.

Chief outlet for acrylic molding powder is still automotive parts where it is used in lenses, three dimensional decorative medalions, horn buttons, and ornamentation. More than 32 different dies are used for the acrylic parts used in the automobiles manufactured by Chrysler. Most of these parts are exterior lenses with from 2 to 4 oz. of acrylic in each. There are more than 100 applications of molded acrylics in the 1950 models of passenger cars produced by 17 manufacturers.

More molded brush backs, standard acrylic application, are also expected in 1950 since the brush manufacturers are apparently about to make a complete overhaul of their designs. Large molded letters for outdoor signs have also been thoroughly tested in 1949 and are expected to become popular in 1950. Molded boxes, containers, jewelry, and cast display blocks containing embedments of all sorts are continuing to take the usual amount of acrylic. One molder is now producing an unusual panel light for the control board of military aircraft which will give a constant white light in the daytime and red at night without tiring the pilot's eyes. It has possibilities for use on automobile instrument boards. The job is an acrylic sheet with a vinyl overlay adhered to it.

Because they take advantage of

the excellent light transmission and diffusion properties of the acrylics. signs are today one of the principal applications of these materials. Large and small acrylic signs are being manufactured in increasing volume for interior and exterior use. One highly striking sign is a store facade in Wilkes Barre, Pa., where a long 8-ft. high section with light behind it is used as a completely luminous background for large-size colored acrylic letters set into the facing. The large petroleum company signs made a year or two ago are outstanding pioneers in this up and coming field.

The use of cast acrylic sheets for display cases, for housings to permit visual examination of moving parts, and similar applications where transparency is essential, is still the backbone of business for many fabricators. And its use in windows for storm sash is still a possibility. More than a possibility, as evidenced by numerous industrial installations, is the use of acrylic sheets for breakage-area glazing.

Acrylic sheet for use in partitions, store facades, and lighting panels is still small in scale. For banks, drafting rooms, and certain show rooms it is ideal as a luminous ceiling through which light may be transmitted. Translucent sheets of from 0.060- to 0.125-in. thick diffuse the light with great efficiency, giving a high dispersion in comparison to the beam of light which comes from direct transmission. Producers are convinced that acrylic sheet used for such purposes may yet become a volume business that will be of no mean proportions.

Table IX—Urea and Melamine Plastics Production and Sales Figures[a] 1946 to 1949[b]

	1946	1947	1948	1949[c]
Adhesives (dry)	40,797,108	48,553,622	52,200,000	40,000,000
Textile and paper treating (dry)	13,534,368	15,948,902	18,900,000	25,000,000
Misc., including laminating and molding	not available	n.a.	48,000,000	47,000,000
Total			119,100,000	112,000,000

[a]Production figures in all years except 1949 which is sales.
[b]Source—U. S. Bureau of Census, Tariff Commission, estimates from producers and users.
[c]Last two months estimated.

Urea and Melamine

CONSUMPTION of urea and melamine resin in 1949 dropped under 1948 in total poundage since the gain in protective coatings, textile treatment, and miscellaneous uses was offset by the drop in adhesives. Use of the two resins had shown a steady increase since 1940, but it should be noted that the figures in Table X for 1948 and 1949 are out of proportion to other years since the Tariff Commission's annual report now includes the filler used in molding compounds, whereas in other years it considered only resin. Melamine resin alone without filler increased from 17 million lb. in 1947 to 24 million lb. in 1948, with a jump of unknown quantity in 1949; but since textile and paper-treating resins grew from 19 million lb. in 1948 to 25 million lb. in 1949, and since melamine molding powder for dishware alone was used at a rate of several million pounds in 1949, it can be assumed that the increase was substantial.

Urea molding powder sales are estimated to have been in the 35 million lb. range for 1949, a figure that has not changed much since the war. The Summer slump cut severely into the year's total, but there was a 15 to 20% increase in the operating rate during the last quarter. Capacity for the industry is estimated to be approximately 60 million pounds.

Table X—Sales of Urea and Melamine (All Types) Since 1940[a]

	Urea and melamine total	*Melamine only (included in total)*
1940	19,000,000	
1945	73,000,000	12,000,000
1946	90,000,000	14,000,000
1947	105,000,000	17,000,000
1948[b]	150,681,000	24,000,000
1949[b, c]	135,000,000	n.a.

[a]Source—Tariff Commission.
[b]Includes between 15 and 20,000,000 lbs. of filler for molding powder which was not included in these figures for previous years.
[c]Estimated. About 15,000,000 lbs. is estimated for coatings and added to 1949 total given above plus 5,000,000 lbs. more to adjust figure to previous years when there has always been an unidentified quantity that could not be classified as related to plastics.

Note that Table IX is based on Tariff Commission's monthly report for plastics only. Table X is from Tariff Commission's annual report on **all** synthetic resins.

Buttons are Largest Outlet

Buttons continue as the largest single outlet for molded urea—some estimators say more than 30% of total volume which is estimated to provide 70% of all production in small buttons such as those used on shirts, underwear, pajamas, and similar items. A 1949 price war in the button industry plus the increase in the number of manufacturers from 10 to 30 since war's end created a disturbance last year but producers assert that urea sales for this purpose were off no more in proportion than other urea items.

Urea closures and jar caps, particularly for cosmetics, are the next largest outlet. Electrical fixtures and housings of various types such as those for scales and clocks suffered somewhat during the period of post-war urea shortage. Many of them were consequently molded in other materials but the industry is now busily engaged in wooing these applications back by placing emphasis on color appeal and ability to meet the underwriters' specifications for electrical properties.

Molders are also being encouraged to include urea in their programs for producing larger pieces and to construct molds that can be used interchangeably with either urea or phenolic. A 19-lb. cellulose-filled urea television cabinet now on trial and 5-lb. toilet seats being molded in quantity are examples of what

can be done with large moldings.

There has been great improvement in molding material—but not much talk about it—since producers got squared away in their new plants. The improved powder is of more uniform bulk and granulation so that there is less scrap loss, fewer rejects, and less difficulty in changing from batch to batch. Also, compounds that save up to 25% in curing time have been developed. These are being used primarily for closures and buttons, but they are not particularly adaptable for larger pieces. since their duration of flow is short. It was thought that the low cost (around 15 cents) of one-color urea, with particularly good electrical properties, might bring it into good volume in 1949, but the increase did not show up. The material probably needs more exploratory work to dig up new applications.

Producers realize that urea has become a special-purpose material in the plastics family and are proceeding to tailor-make their product to meet certain specifications. One producer states, for example, that he expects soon to announce a special-purpose urea with a high luster for cosmetic containers; a fast-curing material that can be adapted for general purposes but is primarily for wiring devices; and a natural urea especially superior for buttons.

Spread of Tableware

The most sensational development in the use of melamine molding material was the increasing acceptance of melamine tableware which is spreading rapidly from commercial use to home use. A national advertising campaign; the approach toward a commercial standard that will assure quality goods; a move by chinaware dealers who proved that melamine was making inroads into their field by attacking its quality were highlights in a year that could easily be called a triumphal march for melamine dishware. Other melamine molded items such as buttons and electrical parts indicated little change in volume or type of application from the year before.

Urea and melamine glues declined in 1949, largely because of the decline in furniture production in early 1949. Urea glue is used primarily for furniture plywood. Plywood manufacturers themselves claimed that they priced themselves out of the furniture market in late 1948, but blamed it on the cost of obtaining logs. But whatever the cause, plywood prices came down in the Summer of 1949 and an immediate increase in sales to the furniture industry took place. The result was that sales of urea glue for plywood, the price of which had remained stable all through this period, bounded upward again with a last-quarter rate of over four million lb. a month which is just about equal to the industry's peak period in the Spring of 1948.

Use of urea and melamine for paper and textile treatment has been advancing steadily since 1946. For paper it is used to give wet strength in bags, toweling, blueprints, crate liners for vegetable shipments, and paper drapes. Melamine is the major material used for this purpose. There are no published figures which separate the amount of urea and melamine used in paper from that used in textiles. The figures furnished by estimators show no semblance of unanimity. We will only go so far as to say that less than half of the total is used for paper.

Textile Uses Jump

The amount of the two materials used for textiles is increasing far more rapidly than that for paper. Urea is used principally for crease- and shrink-proofing of rayon and cotton. Melamine is used primarily for shrink-proofing wool and cotton, but is finding increasing use for wrinkle-resistance and water-repellance. The ratio of urea to melamine in textile treatment is currently estimated as about 5 to 1½.

Urea and melamine producers also have their eyes on the alkyd molding powder field. One producer announced an alkyd molding compound over a year ago. It is an extremely fast-curing material that requires a special fast-action, lightweight molding press. The new material is especially valuable for its non-tracking electrical properties, but it is only the first in a new family of resins that may be designed for many purposes. Presses to handle it have been built by several electrical companies for their own use, and a plastics press manufacturer is reported ready to enter the field. Faith in the future of this new material is indicated by one producer which has devoted one wing of its new plant to alkyd molding powder production.

Nylon

PROGRESS in nylon molding and extrusion material is slow but solid. Each year a few more molders become familiar with handling it. They discover that it isn't so difficult after all and that the molded material has exceptional properties that make it just the ticket for entering what have been otherwise inaccessible market places. An indication that nylon volume is picking up was disclosed when price reductions for several compounds were announced last year. The general, all-purpose material is still $1.60 a lb., but a compound used for wire coating was reduced from $2.22 to $1.85 a lb. and a solution type used over nylon thread to make it stronger and smoother was reduced from $2.50 to $2.25 a pound.

Nylon-coated wire may never reach the volume of vinyl-coated wire but it has innumerable specialty uses, particularly because of its resistance to abrasion and fungus as well as its heat resistance. Several million miles of it were used by the Signal Corps in the war for those reasons. Another advantage is its tough, horny, smooth surface which makes it easy to pull through conduits. It is reported that the new Aluminum Co. of America building in Pittsburgh will contain a large amount of nylon coated wiring. Another reported use is for wire coating in electric blankets because of its non-flammability and ability to take dry cleaning.

Nylon's use as a monofilament for brush bristles, fishing leaders, and sutures is now well established and growing. About 92% of all toothbrushes now have nylon bristles and practically all hair brush bristles are nylon. Hospital hand brushes are now being manufactured with a nylon back as well as bristles so that they can be sterilized. Paint-

ers, both master and amateur, are being educated to overcome their prejudice against nylon bristles, especially since China hog bristles are almost impossible to obtain. An average large brush costs $12 in bristle, $7 in nylon, and $4 in horsehair.

A newly announced use for nylon monofilament is as a boning agent to provide support and hold brassieres in shape. Half circles of monofilaments are placed at the inner edges of each cup of the brassiere.

In Bearings, Bushings

But the big push for nylon in 1949 was for use as bearings or bushings. Because of its toughness, no need for lubrication and no corrosion danger, nylon is deemed highly satisfactory for this purpose. The textile companies in particular are interested because they want to get away from the use of oil in cast iron bearings. One such company is said to be using three million nylon elements in various parts of its equipment.

Office equipment is another branch of industry where nylon has found favor in concealed gears, bearings, shafts, and cams. A precision instrument company is using nylon bushings in recording and controlling thermometers, pressure gages, and the like. It should be stressed that the urge to use such nylon parts is found particularly where the manufacturer wants to avoid use of oil and where the number of pieces is such as to justify the economies of injection molding. Chemical resistance, too, is most important in some cases and helps to explain why nylon is being employed for molding photographic development equipment that is subject to corrosion from acids and alkalies — and in alkaline storage batteries used in miners' lamps.

The limit for size of a nylon bearing today is about 12 in. long and 12 in. in diameter since the material might freeze in the mold if forced to any greater distance. One problem is that experience has thus far been so limited that the producer cannot yet give specific recommendations as to the specific load that can be carried or the maximum temperature resistance. Data are now being gathered for this purpose.

Nylon rod stock can of course be used for bearings but it too is limited in size—2¼ in. diameter is about the largest. The producer has cemented blocks of nylon together with resorcin adhesive to obtain larger pieces but is not satisfied with the result. The company also recommends a block rather than a press fit for bearings because nylon is flexible enough to show a change in internal dimensions if the outside dimensions are press fitted into place. Nylon is not recommended for ball bearings but a nylon raceway could well be used.

Another advantage is that nylon can be easily tooled. No cutting oil or coolant is necessary and a fast cut can be taken. Furthermore, there is no grain. It takes longer to polish than acrylic for example, but if the time can be taken it polishes to a beautiful surface.

Machinery and Equipment

THE approximately 712 injection presses sold in the U. S. in 1949 are separated by size roughly as follows: 365 were 2 oz. or less; 80 were either 3, 4, or 6 oz.; 96 were from 8 to 10 oz.; 113 were from 12 to 16 oz.; 26 were from 20 to 28 oz.; 32 were 32 oz. or more. Thus 58 were 20 oz. or larger in comparison to 40 in that category sold in 1948. Of the 347 presses sold that were 4 oz. or larger, approximately 230 were delivered to custom molders. Foreign sales amounted to 350 machines of which 257 were 2 oz. or less. Of the remaining 93, an estimated 72 were in the 4 to 10 oz. class.

Of the approximately 110 compression presses (all types) delivered in 1949, there were 52 of less than 100-ton capacity (exclusive of laboratory presses). No rebuilt machines are included. Of these 110 machines, approximately 65 were ordered by custom molders. Only 15 compression presses were reported for delivery to molders in foreign countries.

Approximately 346 extruders have been added to the 1949 industry total. Included are a few large-type extruders that were not reported previously. A fairly large, but unknown number of the 1987 extrusion machines listed as the total now employed by the plastics industry are used by raw material companies for various compounding and mixing jobs. There are also a number of machines used by vinyl film and sheet processors for compounding purposes. Therefore, caution should be used by the reader if he attempts to estimate the capacity of the industry for extruded products without making allowance for those factors. Another factor to reckon with is that a large number of the machines sold in 1949 were for polyethylene extrusion and some of these are not yet in full-scale operation. The number of extruders reported for shipment to foreign countries was 132.

Estimated Number of Machines in the Plastics Molding and Extrusion Industry[a]

	1941	1946	1948	1949
Injection	1000	3275	4103	4815
Compression	8000	12,975	13,800	13,910
Extrusion	.....	1150	1641	1987

[a] Based on surveys by Modern Plastics

High-Style Butyrate Bowls

Blending the trends of modern decor with required strength in household products leads to the development of specialty plastic item

THE trend of modern decor is toward simple, clean form and harmonizing colors. The trend in household products, thanks to the increased use of plastics, is toward extreme durability.

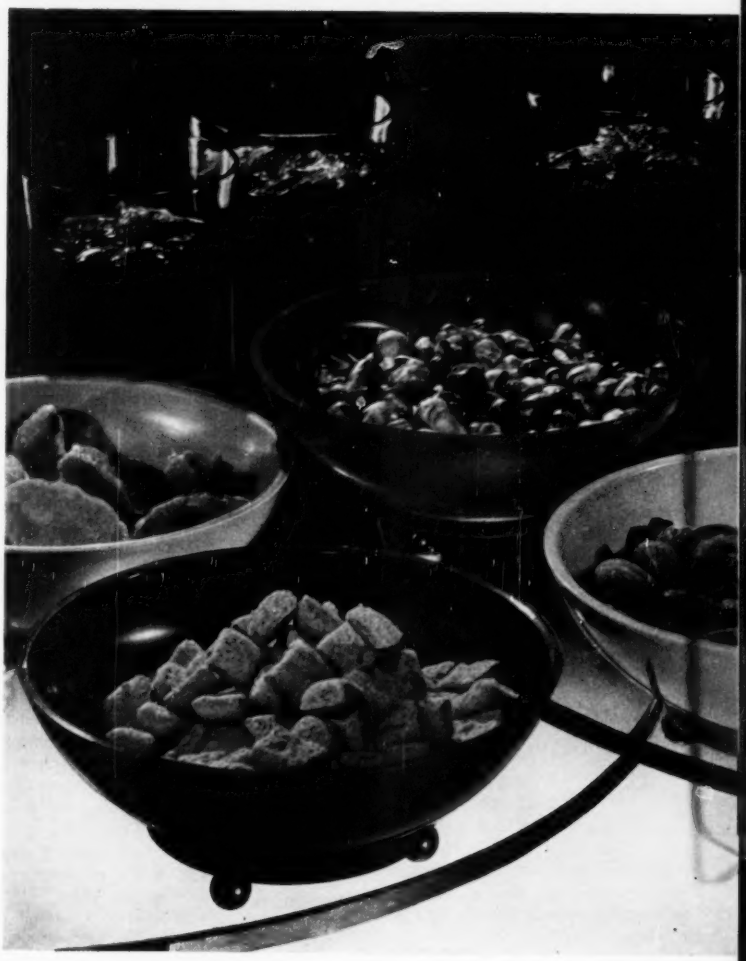
Combining these trends in a group of four hors d'oeuvres bowls, Manchester Molding Co., Manchester, Vermont, is molding the products from Tenite II cellulose acetate butyrate in four decorator colors from the *House and Garden* official palette —mustard, ruby, willow, chocolate.

Designer Louise Thompson, wife of the head of the company, adapted a classic Chinese design to the bowls which are round, rimless, and fairly shallow. They are mounted on three small brass-ball feet.

C. R. Ellingwood, plant engineer, designed the mold—a single-cavity job with a wide gate in the center of the bottom—which is run on a Watson-Stillman 8-oz machine.

A cross-section of the molding cut through the center shows the side walls to be ⅛ in. thick while the base ranges from ¼ in. in the center to ⅜ in. at the edge. This thick section, in addition to providing increased strength and necessary weight for the application, is a factor in the shape of the bowl.

Made of an exceptionally tough plastic in the high-style colors and with a soft lustrous finish obtained from the mold, the bowls combine modern beauty with proof against shattering, and also permit easy cleanability. Four of them sell as a unit under the name Pour Aperitifs.



Bowls of cellulose acetate butyrate have soft lustrous finish obtained from mold—are made according to classic design in four colors. Containers are easily cleaned—unite beauty with strength

Cross section cut through center of plastic bowl molding reveals base ranging in thickness from ¼ in. at center to ⅜ in. at the edges—a factor which offers sturdiness and influences bowl shape

Copolymer Resins for Rubber

by WILLIAM H. AIKEN*

THE reinforcement of rubber by means of a resin instead of the conventional carbon black was one of those happy accidents that came from development work in a completely unrelated field. Early in the 1930's, a cyclized rubber product was introduced under the name of Pliolite. This rubber resin displayed unusual chemical inertness and was soon established as a base for chemical-resistant paints. Because of the inertness of Pliolite, it was incompatible with most of the ingredients used in making conventional paints, and a long, painstaking development program was undertaken to evaluate materials as possible plasticizers and softening agents. One of the materials tested and found to be compatible was natural rubber. From a paint standpoint, however, mixtures of Pliolite and natural rubber were impractical due to the high solution viscosity of the rubber. But tests were made to determine the effect this new resin would have on rubber compounds. It was found that Pliolite actually reinforced natural rubber.

By the beginning of World War II, the use of Pliolite was firmly established in such specialty rubber applications as golf ball cover stocks and wire insulation.

During the war years, tens of thousands of compounds were made in the search for improved synthetic rubbers. The properties desired in a reinforcing resin for rubber were well known[1], and the polymerization chemists were able to make a satisfactory product from styrene and butadiene—the raw material from which GRS is made. GRS is chiefly butadiene, with enough styrene added to give it strength and good workability. The new copolymer-reinforcing resins are chiefly styrene with only enough butadiene to give them compatibility with rubber.

Table I—Effect of Pliolite S-6 on the Hardness of a Rubber Flooring Stock

Parts Pliolite S-6	*Hardness Shore A*
0	83
10	90
20	94
30	98

Pliolite copolymer resins have excellent insulating properties, are used to reinforce wire insulation material for a wide variety of electrical applications

Two copolymer resins have been introduced which give properties in natural rubber equal to those obtained with Pliolite, and properties in GRS and Buna N superior to those obtained with Pliolite. These resins are known as Pliolite S-3 and Pliolite S-6. For most applications, Pliolite S-6 is recommended[2]. Pliolite S-3 is a somewhat softer resin and has a lower heat distortion temperature[3]. It is recommended in applications such as golf ball cover stock and wire insulation where maximum flow of the stock is required.

Properties Imparted

Reinforcement: These copolymer resins reinforce natural and synthetic rubber stocks—that is, they give an all-around improvement in strength characteristics. This makes possible the production of light- and bright-colored rubber articles with excellent durability. In black compounds, these resins give added reinforcement that could be obtained only by overloading.

Washing machine strainer is made of rubber with copolymer resin added

Effect on tensile: When used in small amounts, the copolymer resins usually show little effect on tensile strength. In some GRS stocks, however, 10 to 20 parts of these resins give appreciable increases in tensile. Larger amounts of the resins usually give some reduction in tensile in all stocks.

Effect on elongation: The addition of small amounts of Pliolite copolymer resins to natural and synthetic rubber stocks usually has little effect on elongation. In some GRS stocks, 10 to 20 parts of these resins actually increase elongation. In these stocks the addition of the copolymer resin makes the stock both longer and stronger. When used

*Chemical Div., The Goodyear Tire & Rubber Co.

[1] Thies, H. R., *Ind. Eng. Chem.*, 33, 389 (1941)

[2] Thies, H. R. and Aiken, W. H., *Rubber Age*, April 1947

[3] Borders, A. M., Juve, R. D., and Hess, L. D., *Ind. Eng. Chem.* 38, 955 (1946)

in larger amounts, these resins usually reduce elongation.

Effect on stiffness: Natural and synthetic rubber stocks are effectively stiffened by the use of these copolymer resins. Very stiff stocks can be obtained by a combination of them with either black or mineral filler without sacrifice of other physical characteristics or detracting from processability.

Effect on hardness: Pliolite copolymer resins can be used to give extremely high hardness to black and mineral-loaded stocks without destroying other physical characteristics and still maintaining good processing characteristics (See Table I for effect of S-6 on hardness.)

Effect on tear resistance: These copolymer resins improve the resistence of rubber stocks both to initial tearing and cutting and to continued tearing and cutting once it is started.

Effect on abrasion resistance: The addition of copolymer resins to natural and synthetic rubber stocks improves the abrasion resistance and alters the type of abrasion.

Effect on flex life: The addition of Pliolite copolymer resins greatly improves the flex life of natural and synthetic rubber stocks. A typical example is basketball cover stock. A ball covered with the conventional cover stock failed after 18,000 compressions in a machine that compresses them 33 percent. The stock to which 20 parts of S-6 were added was compresed 60,000 times before failure occurred.

Effect on brittle point: Addition of up to even 50 parts of Pliolite copolymer resins has no effect on the brittle point of GRS and natural rubber stocks. (See Table II for influence of S-6 on rubber compounds.)

Table II—Effect of Pliolite S-6 on the Brittle Point[a] of Rubber Compounds

	Parts of Pliolite S-6					
	0	*10*	*20*	*30*	*40*	*50*
GRS, gum	—65	—65	—60	—65	—65	—60
GRS, 50 parts clay	—60	—60	—60	....	....	....
GRS, 25 parts black	—60	—60	—60	—60	....	....
GRS, 50 parts black	—60	—60	—60	—60	....	....
Natural rubber, gum	—70	—70	—65	—65	—70	—65
Natural rubber, 25 parts black	—65	—65	—60	—65	....	....
Natural rubber, 50 parts black	—65	—65	—65	—65	....	....

[a] In degrees, F.

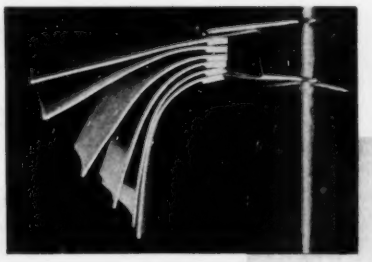
Effect on processability: Pliolite copolymer resins can be incorporated into synthetic and natural rubber stocks either on the mill or in the Banbury. In the case of Banbury mixing, the resin itself can be added directly to the Banbury and good dispersion is obtained. In a rubber compound, the copolymer resins improve processability, for at elevated temperatures they act as plasticizers to soften the stock. Upon cooling, stocks containing these resins shrink less than stocks in which the copolymer resins are not present.

In calender-coated rubberized fabric, the stock is plasticized at the elevated temperature of the calender by the copolymer resins to give a good working stock that results in a smooth surface. This calender coated fabric has excellent abrasion resistance. Although the copolymer resins give high viscosity solutions at rather low solids, the viscosity is reduced by milling the resin in incorporating the rubber. Solutions of 25 to 30% solids, which contain as much as 20% resin, are found to be suitable for spread coating of fabrics.

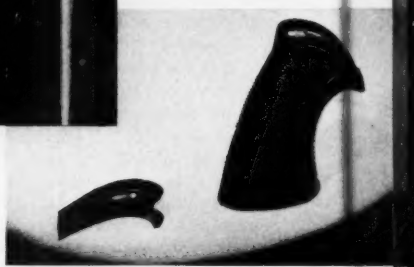
Pliolite copolymer resins promote the flow of rubber stocks to completely fill out a mold and prevent shrinkage, so that the item is a faithful reproduction of the mold. In the extrusion of rubber items, the copolymer resins aid extrusion and insure an excellent surface. In such extruded items as refrigerator gaskets, fire hose, and steam hose, they also add stiffness and general reinforcement.

Effect on cure: Inclusion of up to 20 parts of a Pliolite copolymer resin appears to have no detrimental effect on the curing rate of synthetic and natural rubber compounds. The cure time for some stocks may actually be greatly reduced by the use of the copolymer resins. This is especially true for those stocks in which high hardness is normally

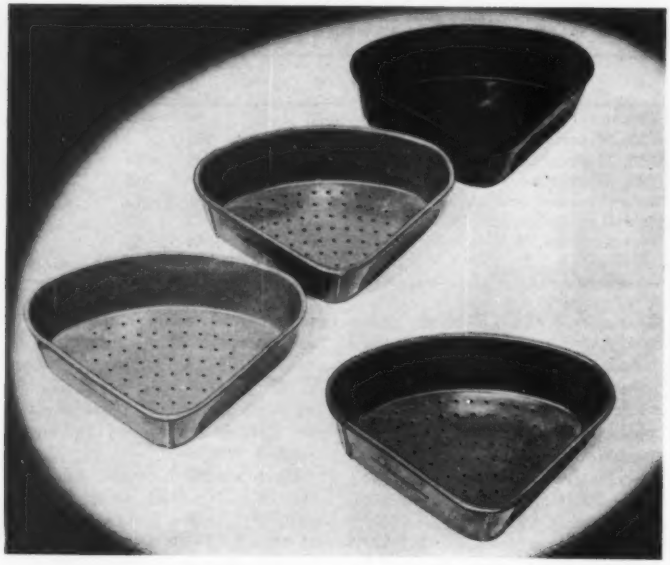
Copolymer resins add reinforcement and hardness to natural and synthetic rubber used in fruit jar rings



Left: Progressive stiffening of GRS: bottom sheet has no resin; top sheet 50 parts



Right: Pistol grip of high-impact strength rubber stock reinforced with a copolymer resin



Sink strainers in bright kitchen colors are toughened and stiffened copolymer resins. Blending of stock and resin does not sacrifice processability

obtained by overcuring. By the incorporation of 10 to 20 parts of resin in the formulation, the cure time can be cut as much as 50% and the same hardness maintained. In stock containing larger amounts of resin, some adjustment of cure may be necessary. It has been found that if no adjustment in curing ingredients is made, the strength properties of a GRS stock began to fall off when 40 to 50 parts of S-6 are used. If, however, the cure is adjusted, the properties continue to rise even upon addition of large amounts of resin. Additional curing agents should be added in the same proportions as if the resin were rubber. That is, if 50 parts of resin are used per 100 parts of rubber, 50% more curing agents should be used than would be used for 100 parts of rubber in which there is no resin.

Effect on aging: The addition of Pliolite copolymer resins to natural and synthetic rubber stocks improves oven aging—especially of natural rubber. Twenty parts of S-6 gives optimum characteristics both before and after aging.

Effect on water absorption: The copolymer resins are hydrocarbon in composition and have very low water absorption. Therefore, in many rubber stocks they lower the water absorption of the compound.

Effect on electrical properties: Table III gives the electrical properties of S-3 and two different mixtures of S-3 combined with a low water-absorption GRS.

The largest present use for these copolymer resins is in hard soles, heels, and top lifts. Rubber shoe soles must have a certain amount of stiffness and hardness, good flex life, good abrasion resistance and good tear resistance—all properties added by S-6. In addition, S-6 improves processability and gives good reproduction of the mold.

Rubber flooring must be hard, scuff resistant, and abrasive resistant. Throughout its years of service it must retain its excellent surface and attractive appearance. Pliolite copolymer resins are used in rubber flooring to give these properties, and to reduce the curing time.

These copolymer resins add reinforcement to wire cover stocks, and improve processing characteristics so as to make possible the extrusion of thin-walled wire insulation of uniform wall thickness. The improved age life given to natural rubber by the copolymer resins is an added reason for including them in such stocks.

Many golf ball manufacturers extend their scarce supply of balata (the usual material for golf ball covers) and at the same time keep the cost of their ball down by using a mixture of Pliolite copolymer resin and natural rubber. The S-3 copolymer acts as a plasticizer for the cover stock so that it flows into the winding to give very excellent adhesion. It is reported that golf balls covered with this stock have desirable characteristics of good click and long flight.

Table III—Electrical Properties of Pliolite S-3

	Pliolite S3	*50 parts Pliolite S3 50 parts GRS 65*	*25 parts Pliolite S3 75 parts GRS 65*
Specific volume resistivity, ohm-cm x 10^{16}, dry	60	....	....
Specific volume resistivity, ohm-cm x 10^{16}, wet	10	....	....
Specific surface resistivity, ohm x 10^{16}, dry	6	....	....
Specific surface resistivity, ohm x 10^{16}, wet	1.5	....	....
Dielectric constant, dry, 1 kc	2.52	2.49	2.40
Dielectric constant, dry, 1 mc	2.60	2.42	2.56
Dielectric constant, dry, 60 mc	2.5	2.35	2.4
Dielectric constant, wet, 1 kc	2.57	2.47	2.56
Dielectric constant, wet, 1 mc	2.63	2.56	2.61
Dielectric constant, wet, 60 mc	2.4	2.4	2.4
Power factor, dry, 1 kc	0.045	0.054	....
Power factor, dry, 1 mc	0.051	0.066	0.066
Power factor, dry, 60 mc	0.9	1.3	1.1
Power factor, wet, 1 kc	0.173	0.101	0.100
Power factor, wet, 1 mc	0.064	0.056	0.053
Power factor, wet, 60 mc	1.4	1.3	1.4

Coffee by the Spoonful

PARTITIONS or baffles serve as automatic measuring devices in two new coffee dispensers which are molded of plastic. The dispensers eliminate the need for using spoons or measuring cups which must be cleaned and are easily misplaced. The use of plastic makes the dispensers light in weight, colorful, and easy to keep clean.

Canister-Type Dispenser

One of the new dispensers is the Tipit, a canister which has the measuring mechanism built into its transparent cover. Lustrex polystyrene is used to mold the opaque canister in bright kitchen colors, and the same material is used for the clear transparent cover. The unit is manufactured by Tipit, Inc., Hollywood, Calif.

The cover of the Tipit has four compartments which can be filled with coffee by tipping the canister. Each compartment holds enough coffee to brew one cup. A knob on the top of the cover rim opens a shutter at the bottom, thus releasing the contents of each compartment.

Accurate coffee measuring canister has polystyrene body and cover. Knob on lid discharges coffee from four chambers, each with enough to brew one cup

Dispenser Top for Glass Jar

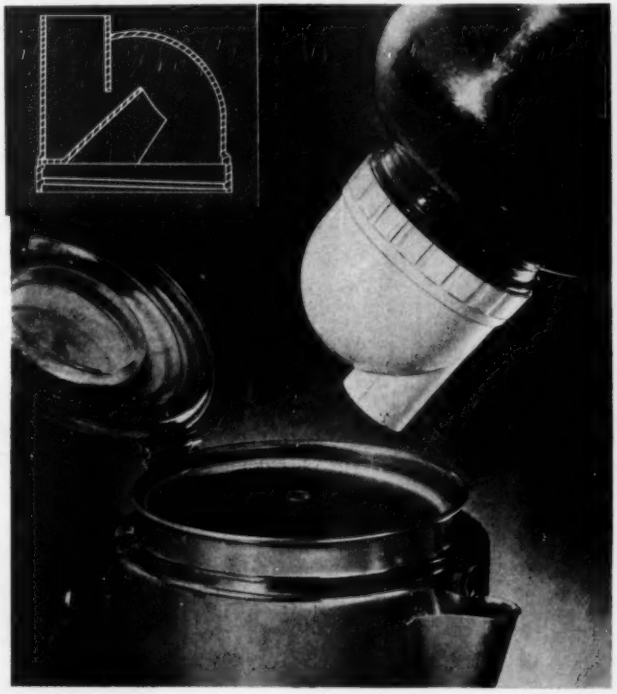
The Coffee Measure Master, made by Measuring Device Corp., New York, N. Y., screws onto the neck of a glass coffee jar. It is designed so that the right amount of coffee for one cup is dispensed each time the jar is tipped.

This dispenser consists of three parts which are molded of Tenite cellulose acetate by Connecticut Plastic Products Co., Waterbury, Conn. The three parts are: the main part of the unit, a baffle which is cemented inside the unit, and a cap which serves as a spout closure.

The baffle is located so that it prevents the coffee in the jar from reaching the spout when the jar is tipped. The baffle also forms a pocket which fills up with coffee (exactly one tablespoon) when the unit is righted. There are no moving parts.

To use the dispenser, the housewife need only remove the snap-on spout cap and tip the jar once for each cup of coffee she wants to make, holding the jar each time until the coffee stops flowing.

Cellulose acetate dispenser screws to coffee jar neck. Spout has snap-on cap. User tilts jar once for each cup desired. Inset: Baffle cemented inside dispenser forms pocket for exactly one tablespoon of coffee when unit is righted

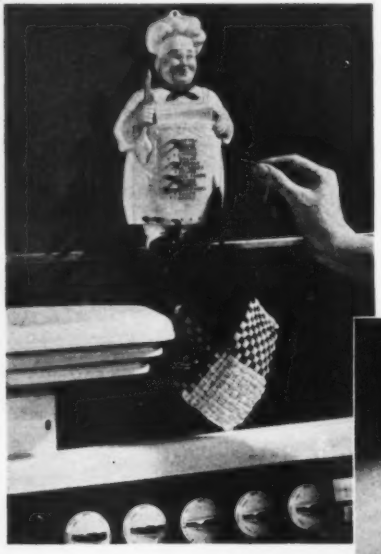


PLASTICS PRODUCTS

Cutting board is made of rubber reinforced with Good-rite styrene-butadiene copolymer resin. Surface will not show knife marks. Reverse side of the 16 by 20-in. mat can be used to protect drain boards or stove tops. Mat is by Wooster Rubber Co., Wooster, Ohio

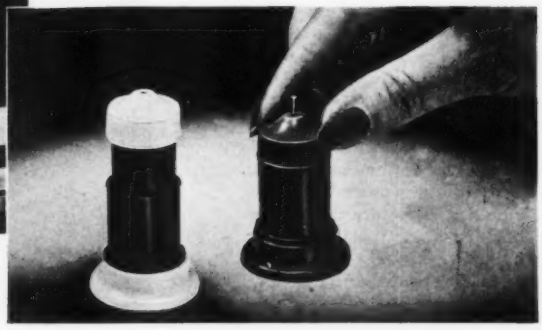
Mimeograph styli have handles molded of Tenite I cellulose acetate. Different colors are used for quick identification of the various tools. Handles are molded by Elmer E. Mills Corp., 2930 N. Ashland Ave., Chicago, 13 Ill., for A. B. Dick Co., 720 W. Jackson Blvd., Chicago

PLASTICS PRODUCTS

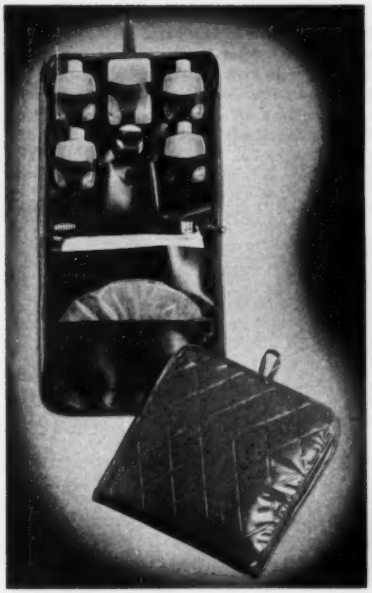


Chef molded of Gering polystyrene holds a memo pad and pencil and has 14 types of foods listed on his apron. Type needed can be indicated by putting wooden peg into proper hole. Pegs are stored in holes at bottom, are used to hang pot-holders on. Happy Chef kitchen memo is made by Noma Electric Corp., 55 W. 13th St., N. Y.

Dispenser molded of cellulose acetate holds a supply of straight pins. When top is pushed down, one pin comes up through hole in center of top. The top unscrews for easy loading. Dispenser parts are molded by Garwood Plastics, Inc., 141 South Ave., Garwood, N. J., for Novo-Plas Mfg. Co., Inc., 32 Fulton St., New York



PLASTICS PRODUCTS

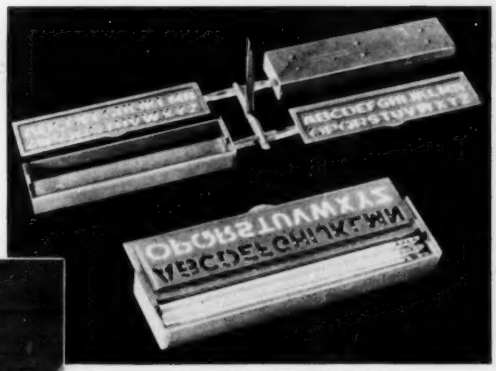


Vinyl bath kit weighs only 14 oz., measures 10 by 10 by 1 in. when closed. Kit has Ultron vinyl cover quilted in Sealtuft pattern, and plain vinyl lining. It is fitted with Plax polyethylene bottles with Colt's urea closures. Made by Simmons Kit Co., 670 Fifth Ave., New York, N. Y.

Faucet filter has two-part housing molded of Melmac, ten layers of fine screen, and chemical filtering elements. Melamine housing is molded by Central Molding Products Co., 5265 W. Grand Ave., Chicago. The filter is made by Mansfield Aqua-Mite Filter Co., 3029 N. Austin Ave., Chicago

PLASTICS PRODUCTS

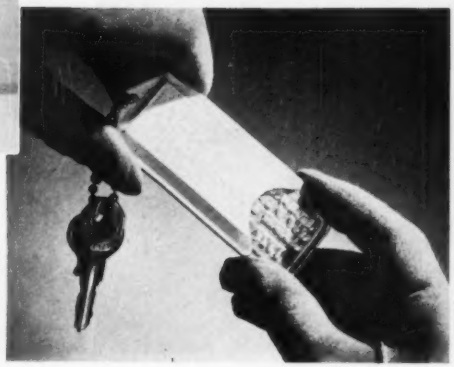
Right: Pencil box molded of polystyrene holds a dozen pencils. Its slide-type lid also can be used as a 6-in. ruler or as a lettering guide. The box, which is used as a package to promote the sales of pencils, is molded by Kusan, Inc., 2716 Franklin Rd., Nashville, Tenn. for the Linton Pencil Co., Lewisburg, Tenn.



Left: Applicator for paste wax consists of two felt rollers mounted in a housing molded of Tenite II cellulose acetate butyrate. Standard 1-lb. can of paste wax is inserted in top of housing. The rollers brush against the wax and transfer it to the floor. The butyrate housing is molded by Ontario Steel Products, Chatham, Ontario, for Brantford Industries Ltd., Brantford, Ontario

PLASTICS PRODUCTS

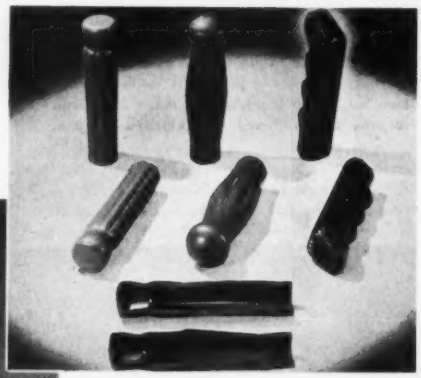
Left: Shampoo shade fabricated of Vinylite film keeps soap and water from getting in the child's eyes and thereby ends his objections to having his hair washed. The shade is made of clear, pink, blue, or yellow vinyl and has an elastic band to hold it in place. It is manufactured by I. B. Kleinert Rubber Co., 485 Fifth Ave., New York



Right: Carrying case for department store credit plates is molded of Tenite I cellulose acetate. The plate slides in from one end and is held in place by a lug molded-in to the inside of the case. The case is available in various colors with the name of the department store molded on one side. It is made by French Mfg. Advertising Co., 344 West Troy, Ferndale Sta., Detroit, Mich.

PLASTICS PRODUCTS

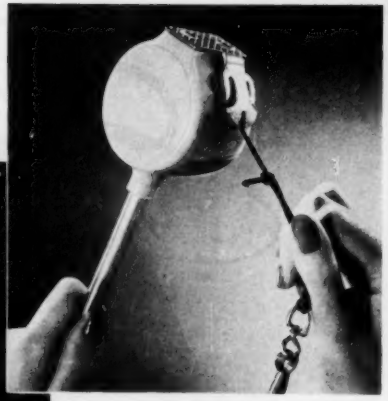
Right: Handle bar grips for bicycles, motorcycles, lawn mowers, and machinery control levers are molded of elastomeric vinyl. They are unaffected by oil or grease, will not get tacky in hot weather, and are more colorful than rubber. Hungerford Plastics Corp., Murray Hill, N. J., molds the grips in three styles and three sizes (⅜, ¾, or ⅞ in. i.d). Note internal ribs



Left: Molded polyethylene re-sealers for beverage bottles, milk or cream bottles, and vacuum cap jars help to keep leftovers from spoiling. The sealers are molded of Du Pont Polythene and are sold carded in sets of five by Kayware Corp., 2731 N. Pulaski Road, Chicago 39, Ill

PLASTICS PRODUCTS

Right: Baby-Minder, designed to give a child freedom to move while keeping him away from potential hazards, consists of line and reel in case molded of Tenite II cellulose acetate butyrate. The case and reel on which the line is wound are molded of butyrate by Breyer Molding Co., 2536 W. Lake St., Chicago. The device is manufactured by Nicro Steel Products Co., 3534 N. Spalding Ave., Chicago



Left: Novelty tree is molded of clear Lustrex polystyrene in three pieces which fit together easily. It can be used for serving hors d'oeuvres, as a trellis for ivy, as a centerpiece, or as a jewelry rack. Molded and distributed by Banner Plastics Corp., 150 Bruckner Blvd., Bronx, New York

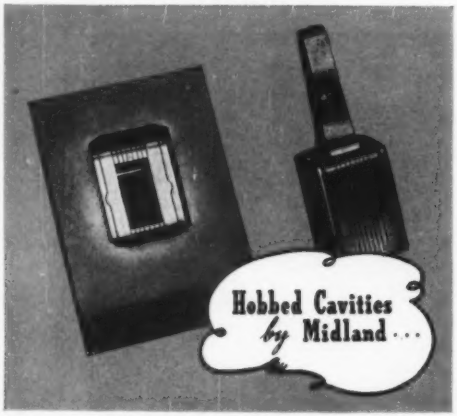
PLASTICS PRODUCTS

Right: Toilet accessories kit is made of Lumite woven saran plaid material and lined with vinyl film. The flexibility of both materials allows the kit to be stored compactly. Container may be washed frequently—is made by Better Bag Container Co., Inc., 37-05 89th St., Jackson Hts., N. Y.

Left: Acousticel microphone has two-part housing molded of Koppers' maroon polystyrene. Lower part of the case has a threaded insert for the stand and a hole for the connector. Upper piece has a removable snap-in screen to give access to the working part of the microphone, which is mounted in sponge rubber. The housing is molded by the Plastic Dept., of the Brush Development Co., 3405 Perkins Ave., Cleveland 14, Ohio, the manufacturer of the microphone

DOES YOUR PRODUCTION MAKE YOU PURR-R?

STEP IT UP WITH HOBBED CAVITIES BY MIDLAND



The arm of this towel holder bracket measures only 3/4" at the base and tapers to only 9/16" at the tip. It is but 13/16" wide—yet this Midland Hob is sunk a total of 3-1/8" into die steel to form a perfect hobbed cavity. It is capable of repeated use in making multiple cavity molds at exceptionally low cost.

Get that desirable output *faster* and more *economically* from multiple cavity molds using hobbed cavities by Midland. The Midland method of producing hobbed cavities guarantees uniformity, superfine finish and serviceability—*at only a fraction of the time and cost of cavity duplication by machining methods.* Intricate detail, unusual contour, extreme depth are handled perfectly at Midland as the cavity at left will illustrate.

If you're planning production of multiple cavity molds for injection or compression molding get into production *faster*—make your production *purr-r-r*—by bringing your problems to Midland. Send for a copy of the book "Shaping Tomorrow Today." It describes the Midland organization, experience and facilities. Do it today!

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Axial Plunger Pumps

Suitable for use on all types of hydraulic molding presses, new "wobble" plate pumps have desirable mechanical and safety features

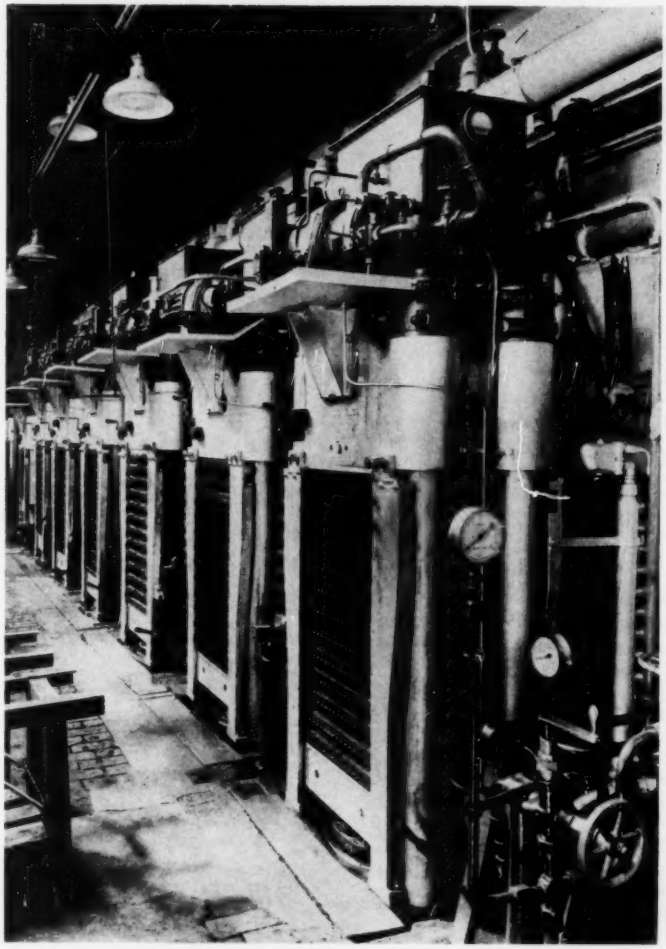
A NEW hydraulic pump has just been announced by Towler Brothers (Patents) Limited, Rodley near Leeds, England. This pump is especially intended for pressure generation in Towler's Electraulic Direct Hydraulic Systems for machine and press operation. This equipment is of particular interest to the plastics molding industry because of its suitability for operating all types of hydraulic molding presses—compression, transfer, and injection. The Electraulic systems are employed where pressure requirements range from 2000 p.s.i. to 9000 p.s.i. and are reported to be employed by the major press builders of England and on the Continent. The Towler company states also that many existing press installations have been converted from group accumulator drive to self-contained presses (as in Fig. 1) with resulting substantial over-all savings in maintenance expense.

The new pump, identified as the Electraulic Axial Plunger Pump[1], is designed to handle a very light viscosity oil with high efficiency.

Plungers in a Circle

In the axial pump, Fig. 2, the pump plungers are located in a circle around the drive shaft and parallel to it. The design involves features in the plunger drive which are believed to be entirely new and which are said to be of considerable importance to the performance of the pump.

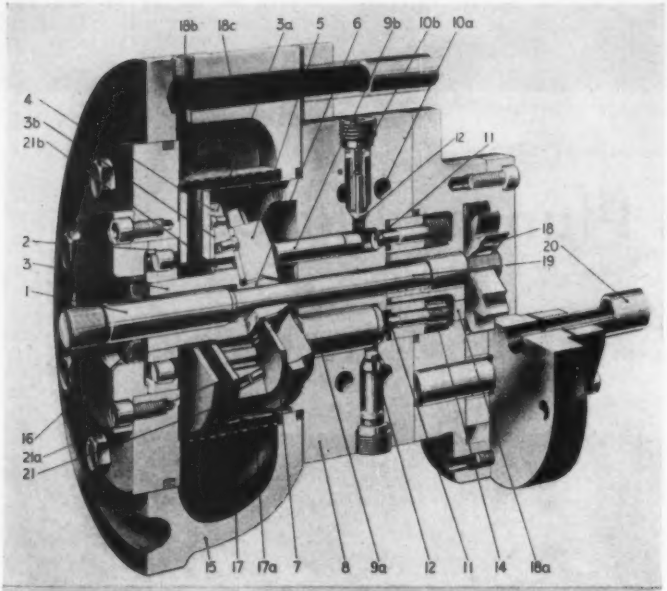
The rotating motion of the drive



ALL ILLUSTRATIONS COURTESY TOWLER BROTHERS (PATENTS) LIMITED

1—A battery of hydraulic laminating presses converted from accumulator operation to self-contained machines with individual axial pump units

*Reg. U. S. Patent Office.
[1]Distributed in North America exclusively by MacMillin Engineering Corp., Chicago, Ill.



2—Longitudinal section through the axial plunger pump. The three major sub-assemblies are as follows: Left: Swashplate drive mechanism. Center: High pressure plunger pump. Right: Low pressure, gear type, booster pump

Key to Reference Numbers, Grouped by Sub-Assemblies

Swashplate Drive

1. Drive shaft
2. Roller bearing
3. Swashplate hub
3a. Swashplate body
3b. Transverse (rear) surface of swashplate.
4. Thrust bearing plate on rear surface of swashplate
5. Wobble plate
6. Journal bearing carried by swashplate to maintain wobble plate in position
7. Thrust bearing plate on oblique (forward) surface of swashplate
15. Housing for swashplate mechanism and pump-to-motor mounting
16. Shaft oil seal
17. Outer baffle screen
17a. Inner baffle plate—perforated
18b, c. Oil outlet passage from housing to supply tank
21. Stationary thrust bearing plate, carried by housing
21a. Radial oil holes to feed oil inwardly to thrust bearings
21b. Axial oil holes through swashplate

High Pressure Plunger Pump

8. Pump body—containing the cylinder bores, valve chambers, and manifolds
9a. Plungers—large diameter
9b. Plungers—small diameter
10a. Delivery manifold—from large cylinders
10b. Delivery manifold—from small cylinders
11. Intake valves
12. Delivery valves
14. Intake manifold

Auxiliary Booster Pump

18. Gear type low pressure pump
18a. Passage from gear pump delivery to high pressure pump intake manifold (14)
19. Shaft extension—to drive gear pump
20. Oil intake—suction line

shaft causes the pump plungers to reciprocate axially, through the action of a "swashplate" mechanism carried by the shaft. All heavily loaded ball and roller bearings have been eliminated. There is but one roller bearing and that is required only to hold the shaft and swashplate in a concentric position with no thrust load. The heavy axial thrust loads are all carried on oil film lubricated thrust bearings on the two faces of the swash member.

The plane of the front face is at an angle oblique to the drive shaft. This face backs up a "wobble" plate through the second oil-film bearing. The wobble plate rides freely on a short journal bearing carried by the swashplate. The forward surface of the wobble plate directly contacts the outer ends of the pump plungers. These ends have a special shape, described as semi-spherical or quasi-conical, so as to provide a large radius of contact between them and the face of the wobble plate. The plungers are held in contact with the wobble plate surface at all times through pressure loading, as will be described later.

No Connecting Rods

This pressure loading feature represents a simplification as it eliminates the need for the conventional system of connecting rods with jointed terminals between swashplate and plungers. However, it also necessitated devising means for controlling the relative motion between the face of the wobble plate and the plunger ends to avoid dragging with resultant intolerable scuffing and wear.

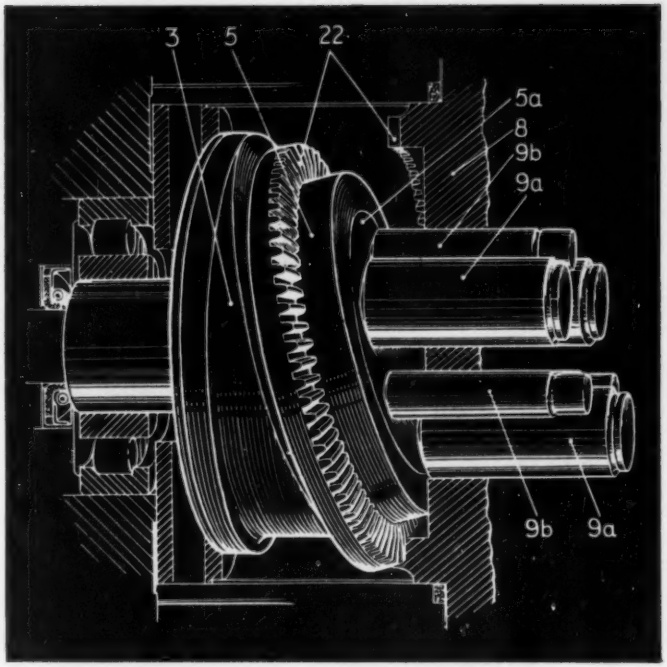
A simple solution to this problem was found in the use of a bevel-geared connection between the wobble plate and the stationary pump body (Fig. 3). The gear ratio is such that the wobble plate is positively constrained to revolve at the correct speed to insure rolling contact between the plunger ends and the face of the wobble plate. The path of this rolling contact of each plunger on the wobble-plate surface is epicycloidal as indicated in Fig. 4. The success of this solution has been verified through extended tests which included 2000 hr. of continuous operation at 7000 p.s.i. and periods of one hour continuous-

ly at 14,000 p.s.i., all with no perceptible wear taking place.

The swashplate mechanism is contained in an oil-tight housing which is arranged for face mounting directly on the end bell of the electric driving motor (Fig. 5) with a flexible shaft drive coupling housed in an intermediate section.

The high pressure pump body is stationary and is mounted directly to the outer end of the drive housing. It contains the cylinder bores in which the plungers operate with a packless precision fit. The system of valving follows the general design employed by Towlers in its previous high pressure pumps, which are stated to have been perfected through extended development. Each cylinder is provided with individual intake and delivery valves of a positively seated poppet type, designed to function at high speeds and without developing fluid slippage or cavitation.

Various combinations of plunger sizes are available in the line of pumps to provide for a range of pressures and deliveries. The pump can be fitted with any of three diameters of plungers as a single high pressure pump; also in combinations of two sizes in one pump, providing a dual high pressure pump in a single, compact unit. In the latter case, the two sets of cylinders have separate delivery manifolds and outlets. The plunger capacity ratios are 1, 2, and 4.



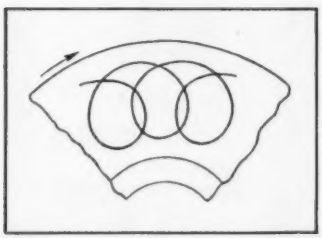
3—Axial pump drive mechanism sub-assembly shown in relation to the full double set of high pressure pump plungers. There are three plungers of each size; the large ones (9a) are alternated with the small ones (9b). The specially shaped plunger ends contact the surface of the wobble plate (5a) against which they roll. The swashplate (3) is rotated by the drive-shaft, whereas the pump body (8) is stationary, but the wobble-plate (5) is made to rotate very slowly in a reverse direction to the drive by means of the bevel gearing (22) which serves as a link between the wobble-plate and the stationary pump body (8)

Low Pressure Booster

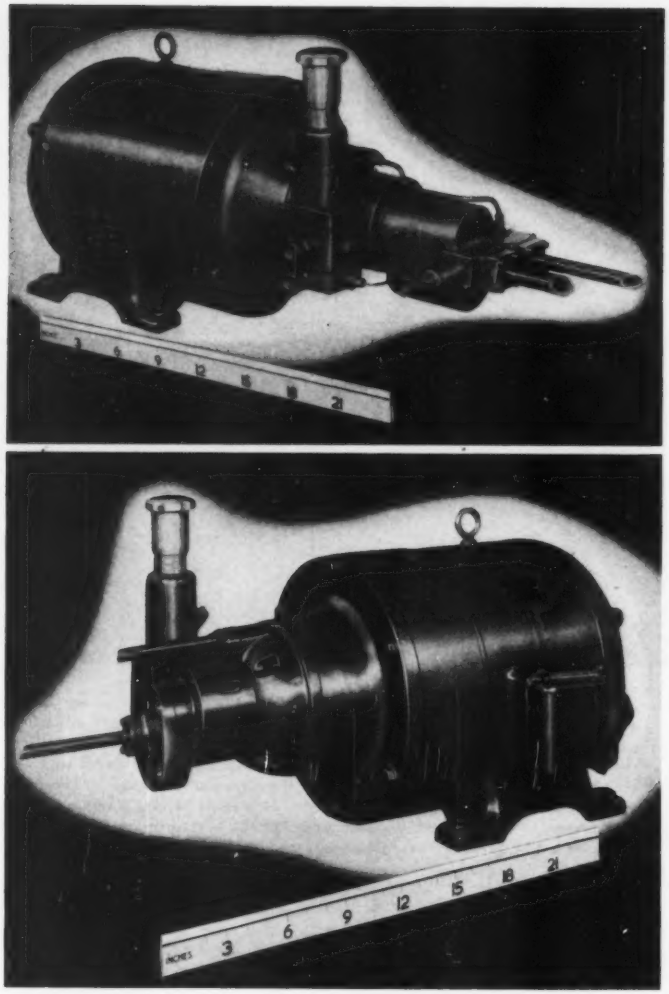
A built-in low pressure gear pump completes the assembly. This is face mounted directly to the outer end of the high pressure pump body. It is powered through an extension of the drive shaft. This auxiliary pump serves primarily as a low pressure booster, delivering the operating oil under a light pressure to the high pressure cylinders through their intake valves to maintain the plungers against the wobble plate as previously mentioned. The total booster pump delivery is in excess of the high pressure pump capacity. The surplus oil from the booster is delivered to the drive casing, and thence back to the oil reservoir.

A constriction in the passage between the intake manifold of the high pressure pump and the drive casing insures proper back pressure for maintaining the high pressure plungers in contact with the wobble plate. On the other hand, should the oil supply fail for any reason, the swashplate mechanism cannot be loaded, as there would be no pressure flow from the booster pump to open the spring-loaded intake valves for the high pressure plungers. Thus the entire mechanism is safeguarded from ever running without lubrication.

The oil flow within the drive casing is controlled by a pair of concentric cylindrical baffles surrounding the swashplate mechanism. The outer one is a fine mesh screen which prevents the entry of grit and scale. This also channels the principal flow of the oil around the outside and out, to dissipate any heat from the mechanism. The inner baffle is a perforated plate forming a narrow annular space between it and the outer screen. Oil collecting within this space is directed inwardly through a series of radial holes in the stationary bearing plate to a space around the hub of the swashplate. From there, centrifugal



4—Contoured pump plunger ends follow an epicycloidal path as they roll on face of the wobble plate



5—Two models of the axial plunger pump, mounted on their electric driving motors. Pump in top photo is equipped with an auxiliary low pressure gear pump. High pressure pump stages are controlled by a dual-function pressure regulator which is adjusted for peak working pressure by its calibrated cap

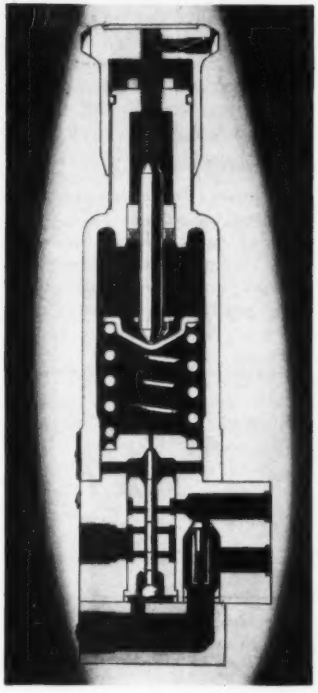
action throws the oil outwardly along radial grooves across the thrust bearing plates, to continually maintain a lubricating oil film on the surfaces. The oil supply within this inner space is augmented and renewed through the normal flow around the high pressure pump plungers, which, though minute, is adequate.

The line of Electraulic pumps has been planned for delivery capacities ranging systematically in a geometric progression of 1, 2, 4, 8, etc. As has been explained, the axial plunger pump is available in double units to afford two capacities, such as in ratio of 1:2 or 1:4. By controlling the output of each stage separately, the effective delivery can be varied in three steps of capacity. By combining two double pumps, one having a capacity ratio of 1 and 2 with another of 4 and 8, it is possible to vary the high pressure delivery in 15 steps.

Additional capacity may be had for low pressure traversing and similar functions from the auxiliary gear pump with which each pump is fitted. This auxiliary may be had in sizes larger than required for its primary function of supplying the high pressure pump.

When sustained pressure is required, as for the cure period of a plastic molding press, a double high pressure pump is employed with capacities of 1 and 4. This pump is fitted with a combination unloading-relief valve (Fig. 6) so arranged that when a predetermined high pressure is reached, the large high pressure volume is bypassed at no pressure and the small volume only is employed to maintain the pressure. The valve is adjustable to the desired holding pressure, with only one setting required for both unloading and holding actions which occur on a close differential.

6—Combination unloading-pressure valve used to control both high pressure units of dual pump



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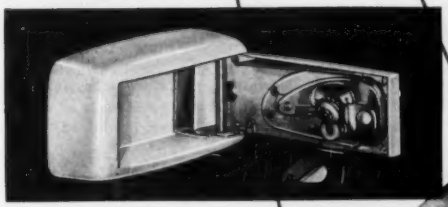
When it's made for the kitchen, housewives expect to be able to wipe it . . . wash it . . . scrub it. And they want modern design. That's why Swing-A-Way Manufacturing Company swung to Plaskon when they designed the *new* Swing-A-Way Cabinet Model Can Opener.

This *new* Swing-A-Way product will retain its aesthetic white dress because all Molded Plaskon Ureas are solid, non-fading colors. Food and detergents will not stain its sanitary-whiteness. And this modern kitchen appliance will withstand kitchen abuse for many years. What's more, the excellent moldability of Plaskon Urea Molding Compounds made it easy for Swing-A-Way to produce a pleasing modern design.

Whether you're designing products for the home or industry, you'll find that *Plaskon Thermosetting* Molded Color has many advantages. Why not have an experienced Plaskon engineer explain them to you. Or, if you prefer, we'll send you free literature.



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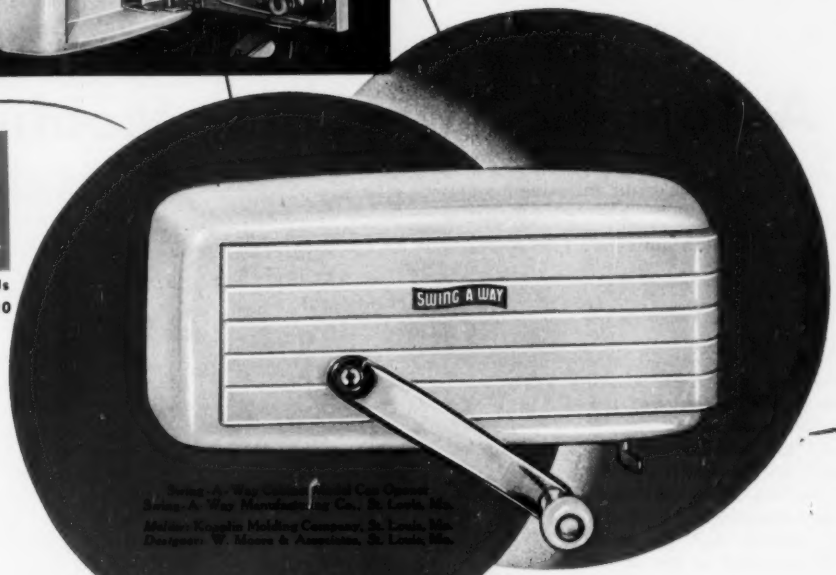

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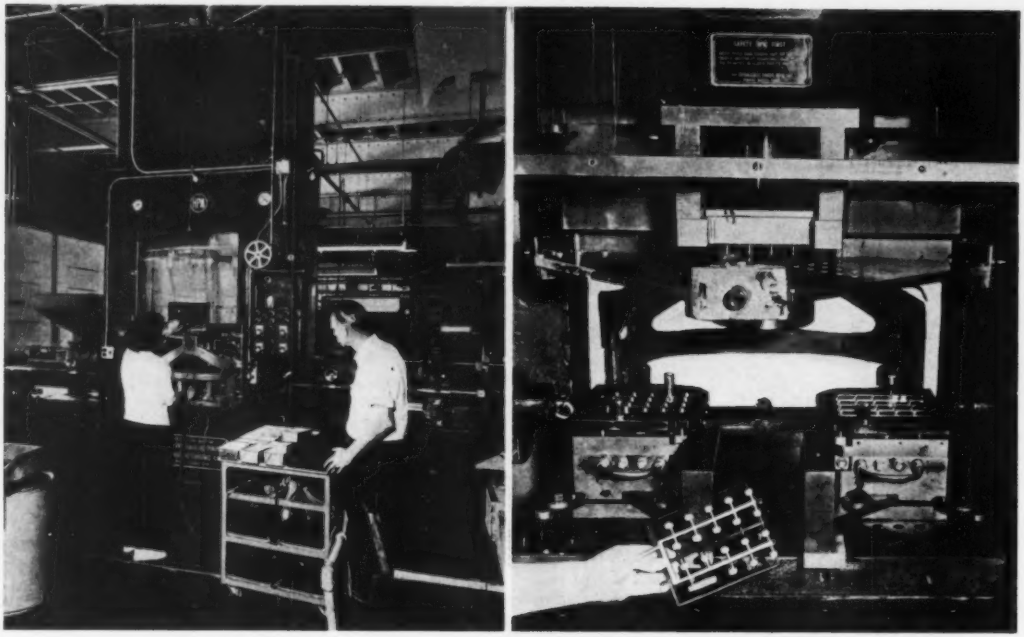


ALL PHOTOS COURTESY THE HYDRAULIC PRESS MFG. CO.

1—All-hydraulic injection machine for automatic two-color molding of calculator keytops. 2—Close-up of the four-station mold with front indexing cam track removed. Mold at left is first color, cooling station is at rear. The second color mold is at right and ejecting station is at the front. Carrier plates are shown in the 45° position

Automatic Two-Color Molding

Calculating machine keys with molded-in characters cost 50% less than old type. Life expectancy of new acetate keys is over 50 years

by R. J. RENHOLTS†

THE USE of "molded-in" characters has long been standard practice for the production of typewriter and calculating machine keytops. The molded depressions forming these characters were filled after molding with a lacquer paste in contrasting color. The resulting keytops had the disadvantage of picking up dirt in half-filled depressions; also, complaints frequently were made that the paint became tacky after the machine had been in use for a few months. This trouble was traced to the plasticizer in the plastic, which came to the surface and softened the lacquer.

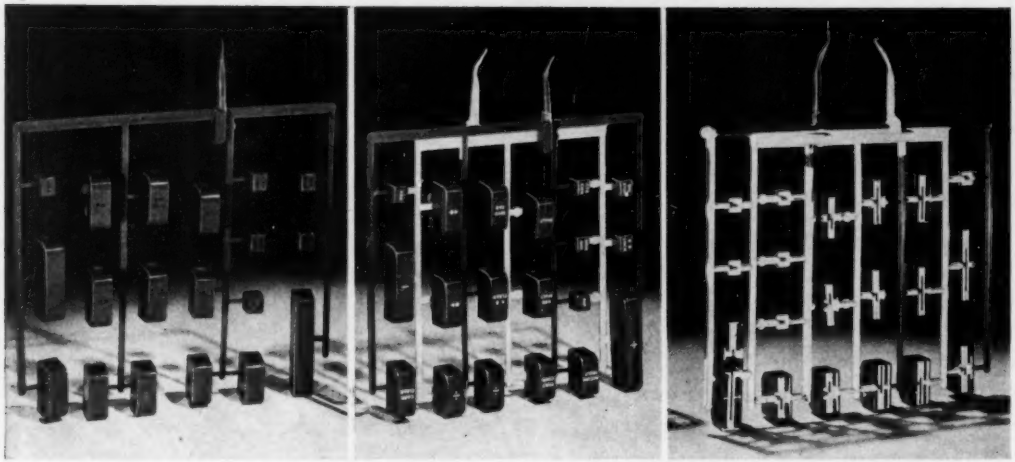
This difficulty could be overcome by using special formulations of filler lacquer, but the cost of hand filling the keytops remained a considerable part of the over-all cost of production.

It recently became obvious that a plastic keytop with a plastic character molded-in in a contrasting color and designed to be flush with the surface of the keytop would eliminate these problems. Such a two-color molding job, however, required two separate molding operations using two separate molds, one for one color and one for the other. Although the quality of such keytops was much better, the all-important cost factor increased.

It was then decided that this two-step operation could be performed automatically on one machine. Our company presented the problem to The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, and this company's engineers designed an automatic machine (Fig. 1) for the job.

This unit is essentially a vertical downward-acting hydraulic mold

†Production manager, Priden Calculating Machine Co., Inc., San Leandro, Calif.



3—First shot (left), second shot (center), and rear view of second shot (right) for Friden's plastic control keytops

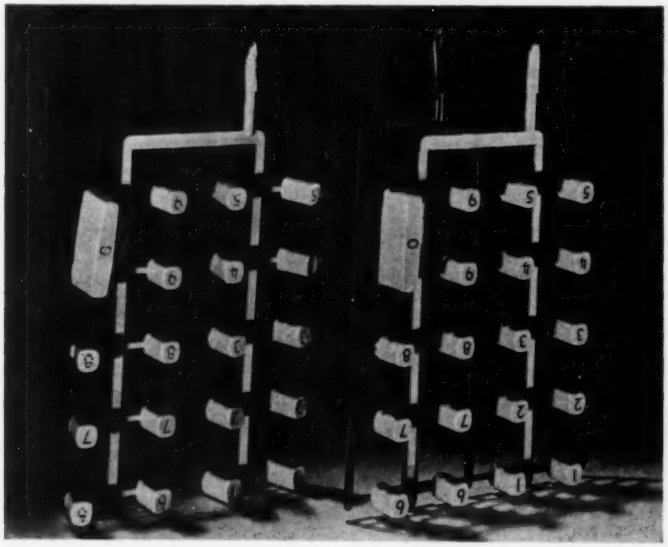
clamp and two 4-oz. capacity opposed horizontal injection units. A unique four-station indexing mold (Fig. 2) permits two color injection, cooling, and stripping operations to be performed simultaneously.

In developing the automatic mold, it was decided to mold the keytop shells rather than the character cores first, since great difficulty would be encountered in trying to hold the cores in the correct position for molding the keytop shells around them.

In the new molding procedure, the first injection "shot" produces the keytop shells which contain the impressions of the characters or numerals together with cross bridging for supporting the centers of numerals such as 9, 8, and 6.

As the vertical mold clamp raises and lowers, it indexes the carrier plate (containing the keytop shells) 90° in a clockwise position to a cooling station. On the next cycle, this carrier plate is automatically indexed to a second mold, where the core material of a contrasting color is injected into the shells forming the filled-in portion of the figures or letters. While the second color is being injected, another set of shells is being produced at the first injection station. The final press cycle indexes the finished keytops into position for stripping them from the carrier plate. The complete molding cycle takes 1 min.—15 sec. for the control keytops (Fig. 3) and 45 sec. for the numeral keytops shown in Fig. 4.

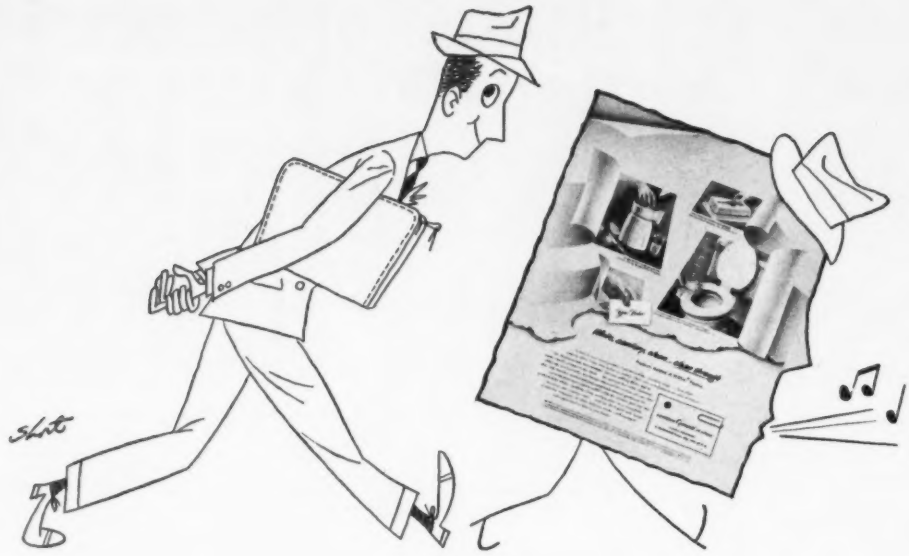
4—Samples of first and second injection shots for numeral keytops. Both shots are molded automatically in single machine. Molding cycle is 45 sec.



Three-Section Molds

The molds are built in three sections. The lower part, mounted to the stationary press bed, contains the core pins. Both lower molds are equipped with stripper plates to guarantee that the molded parts remain in the carrier plates during indexing. Four carrier plates, one for each color mold and one each for the cooling and ejecting stations, are mounted in an indexing spider. These carrier plates contain the side wall cavities of the keytops. The mold sections mounted on the moving mold clamp platen (Fig. 5) contain the cavities which form the faces of the keytops.

(*Continued on page* 90)



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* *The advertisement reproduced on the opposite page is part of a campaign appearing regularly in such publications as* FORTUNE, DESIGN NEWS, MATERIALS & METHODS, PLASTICS WORLD, CANADIAN PLASTICS.

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Makers of some home products want them white—*sparkling* white . . . *clean* white . . . *sanitary* white. White from surface to surface. That's why such products are made of BEETLE . . . the shock-resistant, heat-resistant, low-cost molding plastic that is warm, smooth, pleasant to the touch . . . the material that resists shattering, chipping, won't catch fire and remains unharmed by common solvents. More than that, *fast-cure* BEETLE molding compounds increase production by reducing cure-time as much as 45% to 65%! So, whether *you* want your products to be white—*sparkling, clean, sanitary* white—or in permanent, beautiful, sales-making colors . . . write us. We'll assist with design, production, technical, sales data—help you locate a well-equipped, well-experienced molder in your locality.

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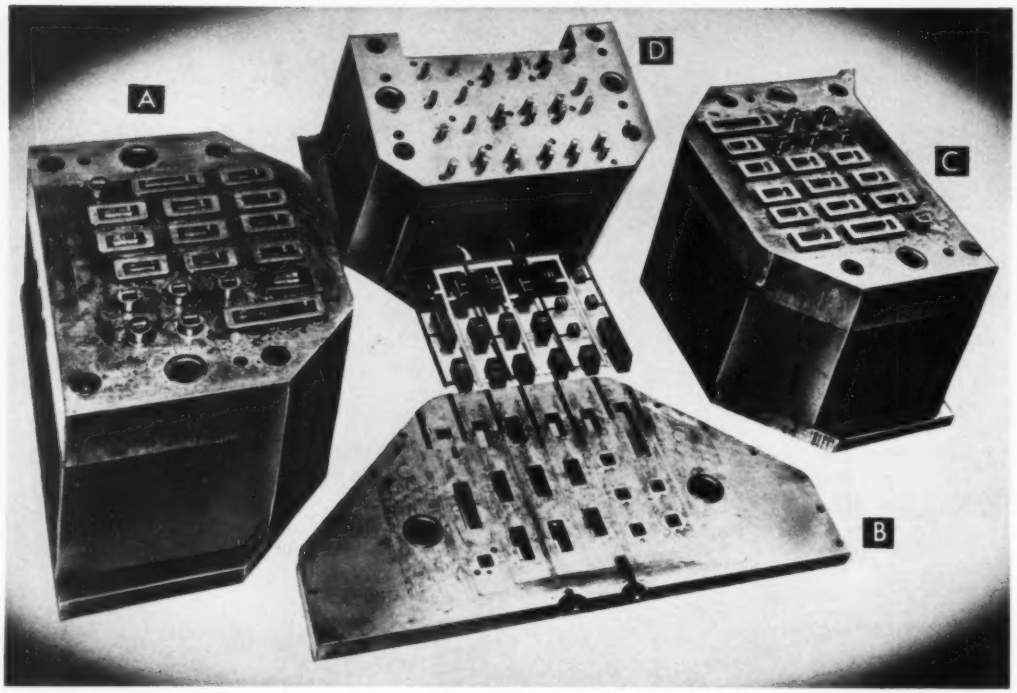


5—Upper part of key control molds, representing the view one would get looking up at the vertical clamp, showing: first color injection (A), indexing carrier plate (B), the second color injection (C), and the knockout pins (D)

The carrier plates are indexed by means of two indexing cam tracks, one mounted at the front of the press, the other at the rear of the press. Movement of the mold clamp platen from bottom position to top position indexes the carrier plates 45° and the downward movement of the mold clamp platen indexes the carrier plates the remaining 45 degrees.

It is not necessary for the operator to open and close a safety gate, as the molded parts are ejected automatically.

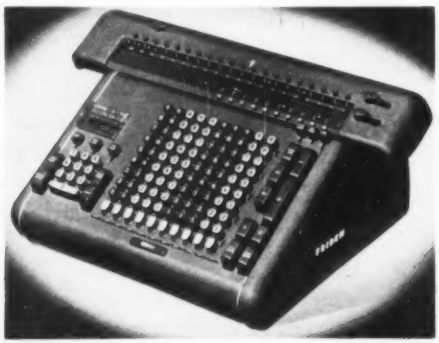
Amortized in One Year

Production savings with the new H-P-M automatic two-color injection machine will completely pay for the injection machine and molds in approximately one year. Actually, this full amortization period would be much shorter if the injection machine were operated on a 24-hr. a day basis, but we can supply our keytop requirements in 8 hr. a day.

In addition to the not unimportant fact that these new keytops cost 50% less than the old filled-in type, they also are far superior in quality to those previously produced; the characters do not wear off with use.

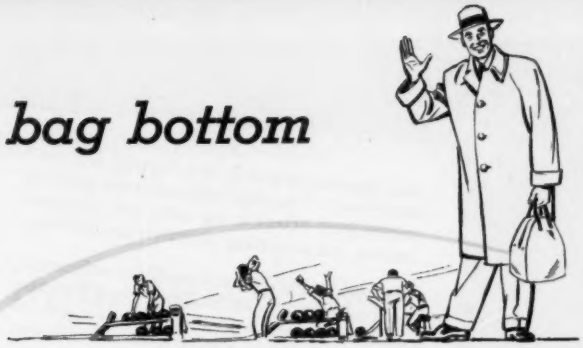
Not only are the new keytops more attractive (Fig. 6) but the "feel" is far superior to the old type. Abrasive tests conducted on these parts disclosed that the keys should last at least 50 years before showing any noticeable wear. Exposure tests to weather show that there is an excellent bond between the two colors of thermoplastic material. No bleeding has been observed.

At present our company is using Tenite I cellulose acetate in the production of keytops although we are considering switching to Tenite II cellulose acetate butyrate because of its more stable properties.



6—Latest model Friden calculating machine in which the automatically injection-molded two-color keytops are used

ten-strike bag bottom



Tenite bowling-bag bottoms afford striking advantages to bowler and manufacturer alike. The lightweight molded part has high impact strength and can't scuff; it resists dirt and is not subject to mildew, corrosion, or drying out—and it is wonderfully uncomplicated productionwise. Molded in a single piece, of which the inside retainer cup for the ball is an integral part, this bag bottom requires only one assembly operation—the rapid joining of bottom to bag, by means of two rows of machine stitching through the tough Tenite and natural-grain leather.

Tenite bottoms are successfully used on golf bags, too, where they must withstand even more dragging and knocking about. Other sporting-goods items for which Tenite supplies toughness and durability are football helmets, fishing equipment, gun stocks, and decoys. For information about the many additional uses of Tenite, write TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Company), KINGSPORT, TENNESSEE.

"Black Beauty" bowling bag manufactured by The Brunswick-Balke-Collender Co., Chicago, Ill. Tenite bottom molded by L & M Products Corp., Chicago.

TENITE *an Eastman Plastic*

Information regarding Tenite is obtainable through representatives located in Chicago, Cleveland, Dayton, Detroit, Leominster (Mass.), Los Angeles, New York, Portland (Ore.), Rochester (N. Y.), St. Louis, San Francisco, and Seattle; and elsewhere throughout the world from Eastman Kodak Company affiliates and distributors.

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Long-Time Tension and Creep Tests of Plastics†

by C. E. STAFF, H. M. QUACKENBOS, JR., and J. M. HILL

Thermosetting and thermoplastic materials were maintained under constant load at 25 and 75°C. for periods ranging from 1000 to 14,500 hours. Creep was measured with electric strain gages, and from its course an estimate is made of the maximum stresses that can be sustained for five years by the thermosetting materials. Both creep and crazing govern the maximum stresses for the thermoplastics and these are estimated for one year. It is believed that the results are not confined to use in potential structural applications but have their greatest value in many problems today. An examination is made of the accuracy and precision of the electric strain gage in measurements of creep.

OVER the past eight years more than a dozen papers have appeared on the creep of rigid plastics and yet our knowledge is far from complete. The common laminates have been fairly well covered, but tests on thermosetting products have not exceeded 1000 hours (1, 2, 3)†† with one exception (4), and of the thermoplastics only cellulose acetate and polymethyl methacrylate have been investigated (5, 6). It is the aim of this paper to provide more information about the thermoplastic and thermosetting types of plastics materials.

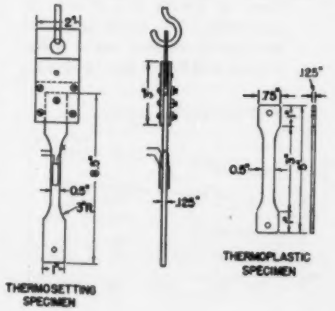
Creep tests for plastics have usually been justified in the past for two reasons. First, the results were thought to be connected with fundamental physical properties. In the present paper this aspect will be neglected although the physical chemist is not excluded from making his own interpretation. The second reason is that plastics were on the threshold of light structural uses. Good creep data, of course, will always find use in structural design but this study was pursued mainly with the conviction that the results relate to many present applications. It is not generally recognized that two practical aspects of creep—namely, sustained stress and continuing deformation—affect so many common molded parts. Examples are: fan blades resisting centrifugal stresses, material around metal inserts under stresses that have arisen from differential contraction, parts under stress from differential water absorption, objects bearing direct load (e.g., coat hangers and bottle caps screwed tight) and moldings shrinking under the influence of high ambient temperature. Under such circumstances creep may either change tolerances or cause weakening and even fracture. The period of stress or deformation may easily be several years and in order to avoid undue extrapolation from laboratory to field the creep test here was usually continued 5000 hr. while a few tests lasted 14,500 hours.

Creep has usually been measured with optical devices except in one laboratory (1, 2, 3) where the value of electric strain gages has been demonstrated. Such a gage was preferred here because of its economy and simplicity. The reliability of an electric gage over a long period of time has been questioned and a secondary objective of this study was to resolve this doubt.

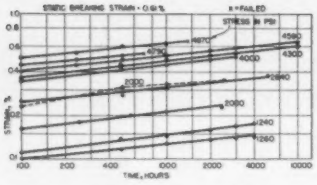
Test Procedures

The thermosetting materials examined were all commercial combinations of a filler and a two-step resin polymerized from phenol and formaldehyde. The percentage and type of resin varied from one material to another. These materials were compression molded. The

1—Specimens, one grip, and hook for loading in plastic creep tests



*Reg. U. S. Patent Office.
† Contribution from the Research and Development Dep't., Bakelite Corp. Presented at the 1949 annual meeting of the American Society of Mechanical Engineers before the Rubber and Plastics Div., and published here through the courtesy of that society.
†† Numbers in parentheses link to "References" at end of article.

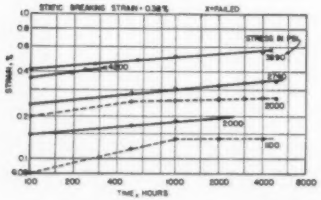


2—Creep at 25° C. for combination of wood flour and phenol-formaldehyde resin at stresses (p.s.i.) indicated. The strain shown includes initial elastic deformation which was 0.078% per 1000 p.s.i. Lines not straight in this chart and Fig. 3 are drawn with dots

thermoplastics were injection molded with the exception of vinyl copolymer which was cut from sheet. Fifty bars of each material were prepared at the same time and kept at 25° C. and 50% relative humidity for periods ranging from one month minimum to two years maximum.

The procedure for most creep tests was as follows. The specimen bearing two SR-4 gages connected in series was put into the grips and hung in the rack. These SR-4 gages, supplied by Baldwin-Southwark, have been described before (1). The gages were balanced electrically, as shown by an SR-4 meter, against two "dummy" gages on a similar specimen, or on a steel bar, hanging nearby under no load. Specimens and clamps are shown in Fig. 1. Ten-point switches designed for use with thermocouples were found satisfactory in allowing several specimens and their dummies to be

3—Creep at 25° C. for combination of macerated fabric and phenol-formaldehyde resin at stress (p.s.i.) indicated. Not shown are two tests at 4450 and 4830 p.s.i. which ended in failure in 1 to 3 days with total deformations of 0.42% and 0.44% respectively. The strain shown in this figure includes initial deformation of 0.067% per 1000 p.s.i.

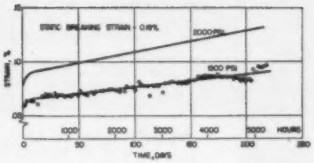


connected to the SR-4 meter in turn. Load was applied directly with iron or lead weights to a pan hooked to the lower grip. Ten 20-lb. weights gave a stress of about 3200 p.s.i. in the specimen. Strain was observed for each increment of load during loading in order to determine modulus of elasticity. After loading, strain was observed every 1, 2 or 3 days depending on the duration of the test. Elastic and delayed recovery on unloading were also observed when desired.

Two ambient conditions were maintained: 25° C. and 50% relative humidity in a conditioned room and 75° C. and uncontrolled low relative humidity in an ordinary circulating-air oven. Holes were drilled in this oven and it was supported so as to surround only the specimen and grips. The weights and frame were outside. At 25 and 75° C. the dummy gages were cemented to a specimen resembling that under test. Such a practice is supposed to eliminate fluctuations arising from minor variations in temperature. At 75° C., in addition, the dummies were carried on steel bars.

Tensile tests were made at 25 and 75° C. in a testing machine, and strain to failure was measured, usually with a mechanical extensometer at 75° C. and SR-4 gages at 25° C.

As an adhesive for electric strain gages, "Duco" cement has been found satisfactory at 25° C. for most common plastics except the polymers of styrene. The "Duco" cement produces a multitude of tiny superficial cracks in these. Such crazing is slight and the bond with the gage is good for the polymers of styrene other than polystyrene. With polystyrene the crazing is bad and the bond is firm only for a few days. Three cements that are effective with polystyrene are a solution of polyvinyl acetate in acetone, a solution of polystyrene in benzene, and cold setting glue (resorcinol-formaldehyde) normally used for wood. The latter is good only for small strains up to 1 percent. When the adhesive is dry, the adhesion should be good enough to allow the gage to withstand prying with the fingernail and flexing of the test specimen by hand. If the gage is firmly attached, it will usually give a proper measurement of creep. If the result is unexpectedly low, it is advisable



4—Creep at 25° C. for combination of asbestos and phenol-formaldehyde resin at stresses (p.s.i.) indicated. Strain at zero time represents initial elastic deformation

to check it with a gage bonded with another adhesive or with dial gages. Finding that initial elastic deformation and instantaneous recovery after creep are equal is no assurance of the bond; it happened with a gage cemented to polystyrene with an aqueous emulsion of polyvinyl acetate, whereas the creep under 1800 p.s.i. at 25° C. appeared to be slightly negative.

For measuring strain at 75° C. the special AB gages were applied to the thermosetting specimens. These gages have a special backing and are cemented with a thermosetting glue that must be baked at 100° C. Such a baking cycle rules them out with thermoplastic, and so cold-setting glue or "Duco" cement was used with the ordinary paper gage. The results so obtained were judged reliable because the strains with gages affixed in this way to a thermosetting specimen agreed with those shown by AB gages on the same specimen up to 1000 hours. At that time the paper gage is somewhat charred. Between 1000 and 3000 hr. the two curves diverge and the charring becomes serious.

Apart from having the SR-4 gage well cemented there are only three precautions which should be observed: 1) At elevated temperatures the dummy must be renewed for each test because it shrinks; 2) Switches should be cleaned every 1 or 2 weeks with a solvent and sandpaper to maintain fresh contacts of negligible

5—Creep at 25° C. for combination of mica and phenol-formaldehyde resin at stresses (p.s.i.) indicated. The strain shown at zero time is initial elastic deformation

resistance; 3) In the portable SR-4 meter the enclosed batteries are small and they may be advantageously replaced with larger, more enduring batteries outside the meter. Meter sensitivity falls rapidly as batteries become exhausted.

Creep of Thermosetting Materials

Creep curves are of most value when they are linear and so can be extrapolated if desired. Four of the six materials tested at 25° C. followed a course that was linear on logarithmic coordinates. These four had fillers respectively of woodflour, cotton flock, macerated kraft paper, and macerated fabric. Two of them are illustrated in Figs. 2 and 3. Note that the ordinate is total deformation, the sum of the initial elastic deformation, which occurs immediately on loading, and creep which accumulates with time.

With a filler of asbestos the creep curve eventually becomes a straight line on rectangular rather than logarithmic coordinates, Fig. 4. When the filler is mica, the creep is so small that it might be interpreted as linear on almost any kind of plot, Fig. 5.

The original points have usually been omitted in order to make the diagrams more effective. The points were first plotted on rectangular coordinates and the best smooth curve was drawn through them, as illustrated for one curve of Fig. 4. Where the coordinates are rectangular, the diagrams in this paper show this curve alone, and where logarithmic the few points shown have been taken from this original curve.

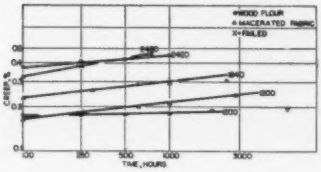
At 75° C., creep and shrinkage go on together. Creep itself is measured by comparing the stressed specimen with an unstressed one at the same temperature. Figures 6 and 7 show the same tendency to linearity as at 25° C. The net strain was given by reference to a steel bar at 75° C. and shrinkage was taken as creep minus net strain. Shrinkage itself follows a linear course on a semi-logarithmic plot, Fig. 8, and was found independent of stress.

In introducing the subject of creep, it was mentioned that continuing deformation is of practical importance. Figures 2 to 7, inclusive, inform us of deformation under stress and Fig. 8 is of interest in connection with operation at an elevated temperature under no stress. All the lines may be extrapolated to longer times if wished.

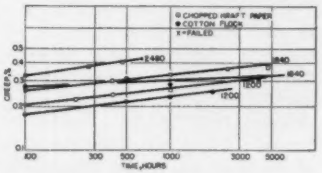
Sustained stress is also of importance and one often wishes to know the maximum stress that can be borne without failure for, say, five years. In this connection consider Fig. 3. Four tests ended in failure in a period of 180 days and in each the total deformation (elastic plus creep) was somewhat in excess of that measured in failure in the short-time tensile test. A similar tendency at 25° C. was noted in Fig. 2. At 75° C. one failure for each of three materials occurred at the same level of deformation.

Thus the five-year strength is established by finding a stress such that the creep line extrapolated to five years does not quite reach the level of tensile breaking strain. Strengths predicted in this way are presented in Table I. The estimates are conservative especially at 75° C. where the creep data are rather incomplete.

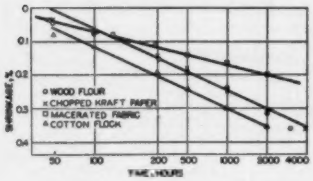
In order to fortify these predictions one specimen of each material was kept loaded for 19 months (14,500 hr.) at 25° C., Fig. 9. The woodflour and asbestos materials under higher stresses than those predicted almost reach the dangerous levels and the lower stresses of Table I are more appropriate. The



6—Creep at 75° C. for phenol-formaldehyde-resin filler combinations at stresses (p.s.i.) indicated. The strain shown includes initial elastic deformation, which was about 0.098% for each 1000 p.s.i. for wood flour, and 0.084% for fabric. Shrinkage is excluded



7—Creep at 75° C. for phenol-formaldehyde-resin filler combinations at stresses (p.s.i.) indicated. The strain shown includes initial elastic deformation of about 0.090% per 1000 p.s.i. with both materials, but omits shrinkage



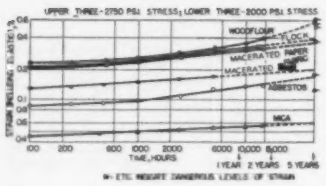
8—Shrinkage at 75° C. for phenol-formaldehyde resin on fillers shown

Table I.—Tensile Strengths and Moduli of Elasticity at 25° C. and 75° C. and Predicted Long-Time (5 year) Tensile Strengths of Phenol-Formaldehyde Materials[a]

Filler	25°C.			75°C.			Notch sensitivity[b]
	Tensile strength	Tensile modulus	5-year strength	Tensile strength	Tensile modulus	5-year strength	
	p.s.i.	10^6 p.s.i.	p.s.i.	p.s.i.	10^6 p.s.i.	p.s.i.	
Woodflour	7800	1.28	2000	8000	1.30	1200	2.0
Asbestos	4400	2.47	1500	4800	2.3	....	1.7
Chopped kraft paper	7700	1.42	2700	6500	1.39	1200	1.3
Macerated fabric	5600	1.49	2000	5600	1.45	1200	1.0
Cotton flock	7500	1.40	2700	6100	1.48	1200	1.4
Mica	5700	4.5	2000	6000	....	....	1.3

[a] The materials tested are commercial products. The type and content of resin varied. They were all virtually linear to failure in tension, and strain to failure can be found by dividing strength by modulus of elasticity.

[b] Notch sensitivity is the ratio of the breaking load in flexure for an unnotched bar 0.4 in. deep to the breaking load for a bar 0.5 in. deep containing the standard A.S.T.M. notch (0.1 in. deep, 0.01 in. radius) in the lower face.



9—Creep tests lasting 14,000 hr. at 25° C. for thermosetting types. Deformations as in Figs. 2-5

others withstand comfortably the predicted stresses.

There are two points of practical importance about these long-time strengths. First, they are quite low in relation to the tensile strengths. Second, they hold only for unnotched specimens. If a sharp notch (or equivalent) is present in the specimen or in a molded object, the figure should be divided by the "notch sensitivity" of Table I.

A quantitative relation between creep and stress is usually of interest. It is remarkable that one equation covers the four materials having fillers of woodflour, fabric, paper, and cotton flock, namely:

$$\log_e \frac{(\epsilon)}{(\sigma)} = 0.103 \log_{10} t + 0.713 \quad \text{"1"}$$

where t = time in hours, ϵ = percent strain (elastic plus creep) x 10^5, and σ = stress in p.s.i.

Within ± 20% this line describes the results for Figs. 2, 3, and 9, and for the data not illustrated for the cotton flock and paper fillers, at four stresses for each ranging from 1180 to 2750 p.s.i. maintained for 2500 to 5000 hours. The exceptions are the three curves of Figs. 2 and 3 that are not linear and the curve which begins to curve upwards at longer times. The equation is not valid for times less than 50 hours.

At 75° C. a similar equation correlates the results except that creep is about 1.5 times greater at any given time. The results are more scattered, reflecting some instability of the circuit at that temperature.

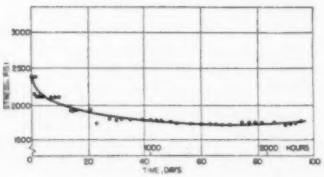
In several papers, one by W. N. Findley for example (5), appear graphs relating stress versus time to fracture. For four materials here, equation "1" can be manipulated, in conjunction with the constant level of critical breaking strain, to demonstrate that such a graph would be linear on logarithmic coordinates.

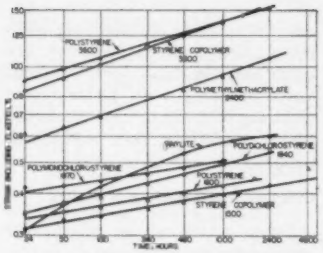
Relaxation, or the decline of load necessary to maintain constant strain, is sometimes of interest. Usually the greater the creep, the greater the relaxation. A closer connection has not been evolved except for thermoplastics under high temperature. One relaxation curve is shown in Fig. 10.

No extensive measurements were taken of creep recovery after unloading. Instantaneous elastic recovery at 25° C. is equal to the original elastic deformation. In 13 instances the difference between these two elastic deformations averaged 0.004% only. After the usual exposure to 75° C. for 1 hr. before a creep test was started, the modulus of elasticity was about 20% lower than at 25° C. The instantaneous recovery on unloading after several hundred hours at 75° C. was always lower than the initial elastic deformation because the modulus had risen about 20% in that time.

Few other results exist for comparison. The several materials exposed for 1000 hr. by Telfair, Carswell, and Nason (1) and the one material for several thousand hours by Findley (4) resemble the ones in this paper. The curves are not linear on rectangular or semi-logarithmic coordinates but might become linear on logarithmic coordinates. The creep deformation is of the same order. The several authors of the one paper predict by a procedure not described a "stress below which no practical danger of failure exists." The predictions agree with those of Table I. In spite of this apparent success of forecasts based on 1000 hr., it is suggested that a new material be run at least 5000 hours. Lower times

10 — Relaxation (constant strain) at 25° C. of a thermosetting material with a filler of kraft-paper. Initial stress, 2400 p.s.i.





11—Creep at 25° C. for various thermoplastics at stresses (p.s.i.) indicated. Initial elastic deformation may be computed from moduli of Table II found on page 98

might be sufficient for a product closely resembling one already tested.

It has been suggested (2) that elevated temperatures promote further curing and hence shrinkage in molded thermosetting specimens. Another possibility is that such shrinkage is connected with the loss of water by diffusion. Under conditions when further curing is probably absent (vacuum desiccation at 25° C.) a woodflour-filled material shrinks about 0.2% for each percent of weight lost.

Measurements of the weight for a woodflour material at 75° C. showed a loss of 2.4% at 250 hours. At 1000 hr. the loss reached 3% and remained constant for longer times. If these losses are assumed to be all water they are far too large to account for the shrinkage observed, assuming a shrinkage of 0.2% for each percent lost. It is not permissible to assume that other volatiles were lost and that the water alone would account for the shrinkage because shrinkage continues after 1000 hr. although weight loss ceases. It is probable that shrinkage at 75° C. is caused both by loss of water and by further curing.

Creep of Thermoplastics

The curves relating deformation and time for thermoplastics generally become linear when plotted in the same way as the thermosetting materials, Figs. 11, 12 and 13. The cellulose plastics are exceptions and their curves are shown on rectangular coordinates (Fig. 14). A comparison of creep alone for several thermoplastics is given in Fig. 15.

The data are not comprehensive enough to allow stress to be corre-

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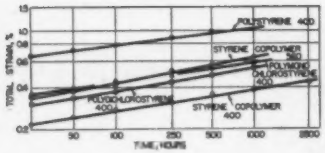
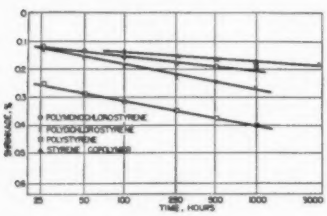


12—Creep at 75° C. for various thermoplastics at stresses (p.s.i.) indicated. Strain includes initial elastic deformation; no shrinkage

lated with creep as in equation "1". Judging from results at two stresses, deformation increases out of proportion to stress. Temperature has a tremendous effect on creep. For example, between 24 and 2400 hr., polystyrene at 25° C. creeps 0.6% under 3600 p.s.i. and at 75° C. creeps the same amount under 400 p.s.i. The ratio of nine (3600/400) for polystyrene is lower for the other styrene polymers.

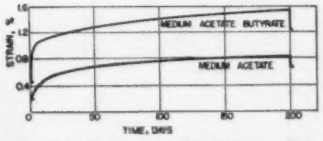
Several thermoplastics differ from other thermoplastics, and from thermosetting and laminated products, in that they can soon exhibit crazing or internal cracking under sustained load. Such crazing promotes premature failure. For example, polystyrene under 1800 p.s.i. at 25° C. exhibits quite low creep, Fig. 11, and yet separation into two parts occurred in one test after 5700 hours. At a lower stress, 1200 p.s.i., there is no danger of failure under 10,000 hr. but definite craze marks were observed in 5 to 10 days. The user of polystyrene would probably feel uneasy or dissatisfied if craze marks did appear and their appearance can be considered as defining failure. This phenomenon of crazing under stress was observed with polystyrene from several sources, with annealed polystyrene, with a copolymer of styrene and acrylonitrile and with polychlorostyrenes. Crazing occurred when SR-4 gages were not applied and, therefore, it cannot have arisen because of chemical attack by the cement. There was no crazing under the low stresses used at 75° C. and a limiting deformation provides the criterion of failure (see below).

13—Shrinkage of thermoplastic materials as observed at 75° C.



Crazing was not observed at 25° C. with the cellulose plastics, with "Vinylite" (a copolymer of vinyl chloride and vinyl acetate), or with polymethyl methacrylate. (The latter was found to craze under 3600-5400 p.s.i. by Chasman (6). These stresses exceed those suitable for enduring use). With these plastics that do not craze, the deformation to failure, whether in a short or a long time, is much in excess of 1 percent. However, a deformation of 1% is usually the acceptable limit. A bar 8 in. long and 0.5 by 0.5 in. in cross section when clamped at one end would deflect 0.8 in. at the other if the load there caused a strain of 1% at the clamped end. Accordingly, the long-time strength will be such that the total deformation does not exceed 1 percent. At 75° C. the proper curves to which this criterion should be applied are those representing net deformation (total deformation minus shrinkage). However, there is so little knowledge of behavior at 75° C. that a factor of safety will be applied by considering total deformation.

With the criteria of failure discussed above one can estimate long-time strengths. The data are less thorough than those for the thermo-



14—Creep of cellulosics at 25° C. and 640 p.s.i. Time zero strain is initial elastic deformation

setting materials and the predictions of Table II are for one year. The estimates are conservative. With polymethyl methacrylate at 25° C. and polystyrene at 75° C. there are no creep data at the estimated stresses, and the very rough approximation was used that total creep is proportional to stress.

The results of Table II may be discussed in several ways. Thermoplastics often have a higher tensile strength but are less satisfactory for service under enduring stress than thermosetting materials. The heat distortion temperatures (A.S.T.M. D648-45T) for the four polymers of styrene are: polystyrene 83° C., styrene-acrylonitrile copolymer 92° C., polymonochlorostyrene 100° C., and polydichlorostyrene 106° C. Evidently these values are a poor reflection of the serviceability at 75° C. indicated by creep tests.

The problem of cracking around inserts may be analyzed. When a piece containing an insert cools after molding, stresses arise because the plastic shrinks more than the metal. At room temperature a stress will

Table II.—Tensile Properties of Thermoplastics at 25° C. and Predicted Long-Time (1-Year) Tensile Strengths at 25° C. and 75° C.

Material	25°C. *Tensile strength*	*Tensile modulus*	*Strain to failure*	*One-year strength*	75°C. *One-year strength*
	p.s.i.	*10^5 p.s.i.*	*%*	*p.s.i.*	*p.s.i.*
Polystyrene	7500	0.48	2.1	800	250
Polymonochlorostyrene	9500	0.52	2.5	1200	400
Polydichlorostyrene	5900	0.60	1.0	1500	400
Styrene-acrylonitrile copolymer	9100	0.43	2.2	1500	560
"Vinylite"[a]	.....	.....	.....	1600	.....
Cellulose acetate[a]	6700	0.35	5.5	600	.....
Cellulose acetate-butyrate[a]	3900	0.16	9.5	less than 600	.....
Polymethyl-methacrylate[a]	10,100	0.43	4.2	2000	.....

[a] Properties can vary with the mode of preparation. This is especially true with the cellulose plastics. "Medium" cellulose acetate and cellulose acetate butyrate were used here.

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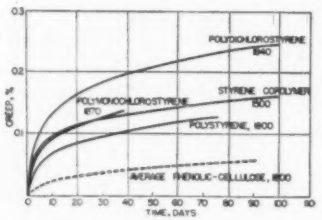
be present of a magnitude depending on the temperature at which the plastic becomes rigid and on the coefficient of expansion. With the four styrene polymers of Table II the coefficient of expansion falls as the softening point rises in such a way that the expected stress is about the same for all. Their tendency to crack around inserts will be governed, therefore, by their long-time strengths at 25° C. Accordingly polystyrenes would crack most readily around inserts. There has been some practical confirmation of this.

The reason for the shrinkage of thermoplastics at 75° C. is not known. The loss in weight of the styrene polymers is quite small. It reaches 0.1 to 0.5% at 100 hr. and remains constant for longer times. Coiling of the polymer chains probably accounts for shrinkage at 75° C.

Reliability of the SR-4 Gage

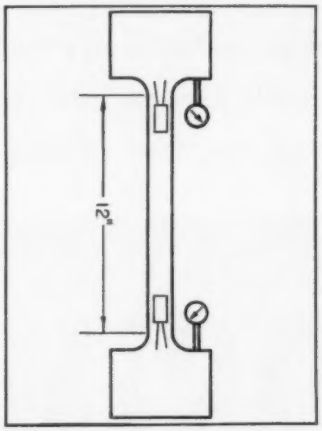
Popular suspicion still attaches to the measurement of creep by electric strain gages. There are questions as to the reliability of the bond between the specimen and the gage and as to the constancy of the electrical circuit over a period of time. The following experiments were designed to resolve the doubts.

The creep of a vinyl copolymer under 1560 p.s.i. at 25° C. was measured simultaneously by dial gages, reading to 0.0001 in., and by SR-4



15—Creep alone of thermoplastics at 25° C. at p.s.i. stresses shown

gages cemented with "Duco" cement. The specimen cut from a sheet 0.1 in. thick was made long to increase the accuracy of the dial gages. These gages were supported by the testing frame and were held against the edge of the specimen by the spring of the gage, contact being confined to a small area by means of clips, Fig. 16. The use of two dial gages eliminates any effect arising when the specimen shifts slightly in the upper grip or jaw. The SR-4 gages were applied on both sides in two locations to give a mean result. The creep shown by the SR-4 gages is lower than that given by the dial gages, Fig. 17.



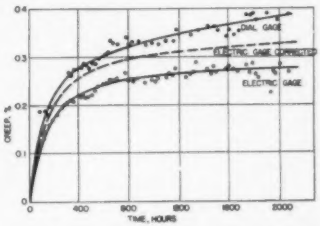
16—Creep measured by electric and dial gages on 0.1-in. Vinylite

Part of the discrepancy in Fig. 17 may arise because the electric gages actually stiffen the material in their neighborhood. After the creep experiment the central portion of the specimen of Fig. 16 was cut out and pulled in tension. The electric gages and mechanical extensometers applied to span them showed 15% less elongation at a given load than mechanical extensometers outside the region covered by the electric gages. This means that of the 103 lb. applied in the creep test, 15% or 15.5 lb. are carried by the SR-4 gages and only 87.5 lb. are taken by the adjacent vinyl copolymer. Outside the sections covered by the electric gages, the total load is, of course, borne by the plastic. In partial confirmation, one SR-4 gage (coated with "Duco" cement) when loaded by itself needed about 4 lb. to register the initial elastic deformation of 0.248%.

When creep starts, the load carried by the plastic may continue to be 87.5 lb. or may change according to the way in which the SR-4 gage and the bond creep under their portion of load. Under the 4 lb. noted above, the gage was found to creep (determined by readings on the SR-4 meter) more rapidly at first than the vinyl copolymer in Fig. 16, but after 72 hr. settled down to approximately the same rate. When loaded with 7.75 lb. (15.5 lb. for two gages), the creep was much more rapid. It is uncertain whether we should prefer the load of 4 lb. and the proper initial deformation of the gage or the 7.75 lb. which corresponds with the proper stiffening. It will be assumed that not only during initial loading but also during creep that the plastic carries only 87.5 lb. and the adjacent gages 15.5 lb.

The creep curve using electric gages may, therefore, be corrected for stiffening by multiplying all ordinates by 103/87.5, where creep is assumed proportional to stress. The corrected curve of Fig. 17 is still low but it is fair to say that the electric gage gives a good indication of the actual creep in its area.

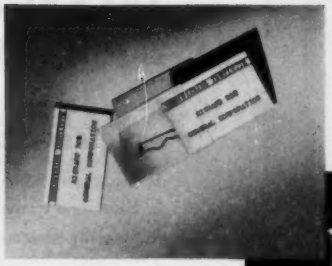
With several thermosetting specimens ⅛ in. thick, tensile loading was applied with and without electrical gages in the section spanned by a mechanical extensometer. For duplicability it was found necessary to apply the extensometer to each edge in turn rather than to the face of the specimen. The stiffening effect was



17—Vinylite creep at 25° C. and 1560 p.s.i. according to two gage types. Initial elastic deformation on electric gages was 0.248%

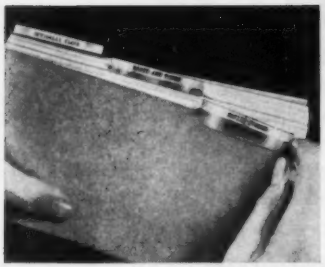
11% with fillers of woodflour, cotton flock, and asbestos. The creep of these materials is comparatively low, so that the 89% of load borne initially by the specimen tends to increase during creep. If this is neglected, the creep curves are about 11% low.

(*Continued on page 144*)



LAMINATIONS. Material: Kodapak I Sheet, clear, to foil and board. Suggested gauges: .001″ and .0012″.

BADGE HOLDERS. Material: Kodapak I Sheet, clear. Suggested gauges: .005″ to .010″.



INDEX TABS. Material: Kodapak I Sheet, clear. Suggested gauges: .003″ to .015″.

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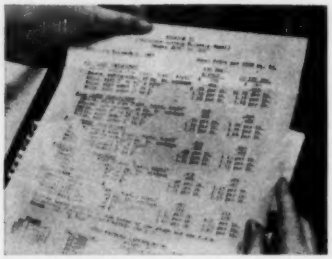
WALLET INSERTS. Material: Kodapak I Sheet, clear. Suggested gauge: .005″.

PROTECTIVE FOLDERS. Material: Kodapak I Sheet, clear. Suggested gauges: .003″ to .0075″.



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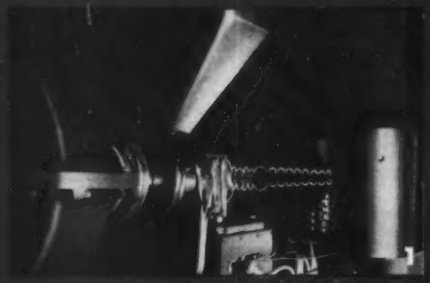
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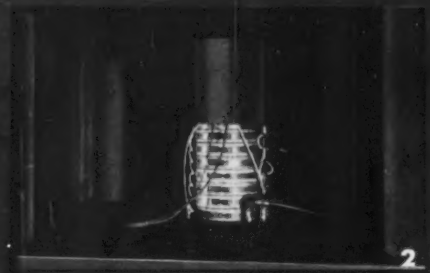
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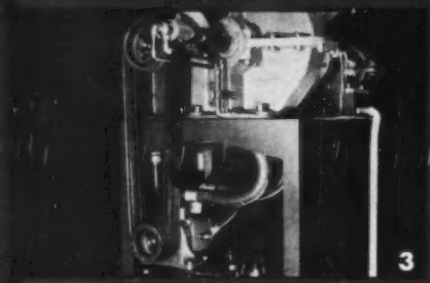
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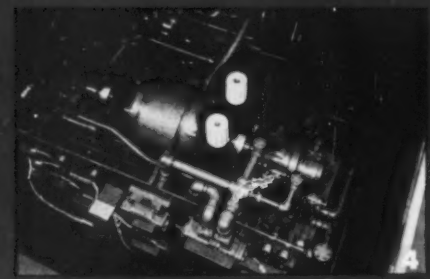
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PRE-PLASTICIZING

(1) PRE-PLASTICIZING MEMBER

1. Electrically heated member
2. Four zone temperature control
3. Specially designed stainless steel extruder pump
4. Stainless steel hopper
5. Water cooled thrust bearing and leakproof lubricant seals
6. Temperature controlled hopper
7. Standard coupling and gear box for ease of maintenance

ADVANTAGES

1. Insures complete and uniform temperature of plastic at discharge port of this unit
2. Compounds acetate, ethy-cel, vinylite, etc. through mulling action of specially designed extruder pump
   (a) Colors polystyrene, acrylic, through mulling action
3. Capacity on surge basis, 360 lbs. per hour polystyrene

(2) TROUBLE-FREE INJECTION CHAMBER

1. (a) Eliminates troublesome torpedo
   (b) Electrically heated nozzle ram and chamber
2. Two zone temperature control
3. Co-efficients of thermal-expansion closely controlled
4. Temperature of controlled upper head is to safeguard against expansion of press
5. Yoke clamped to pre-plasticizing member for positive no-leak clamping.

ADVANTAGES

1. (a) Elimination of plasticizing in injection chamber
   (b) Results in faster cycles
   (c) Mold is now limiting feature with regard to cycle
2. Injecting thoroughly heated plastic at low pressures into mold
3. Results in strain-free moldings
   (a) Greater projected area possible
4. Elimination of stuck sprues, through specially designed nozzles

(3) DRIVE FOR PRE-PLASTICIZING MEMBER

1. Trouble-free fluid motor
2. Standard proven V-belt and sheave drive
3. Proven gland for temperature control within extruder pump-screw

AVAILABLE IN 8, 24, 48, 64, AND 80-OZ. MODELS

500 SQUARE INCHES PROJECTED AREA AND 360 LBS. PER HOUR ON 48 OUNCE PRESS

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PRESS* REVOLUTIONIZES MANUFACTURE OF PLASTIC PRODUCTS . . .

ADVANTAGES

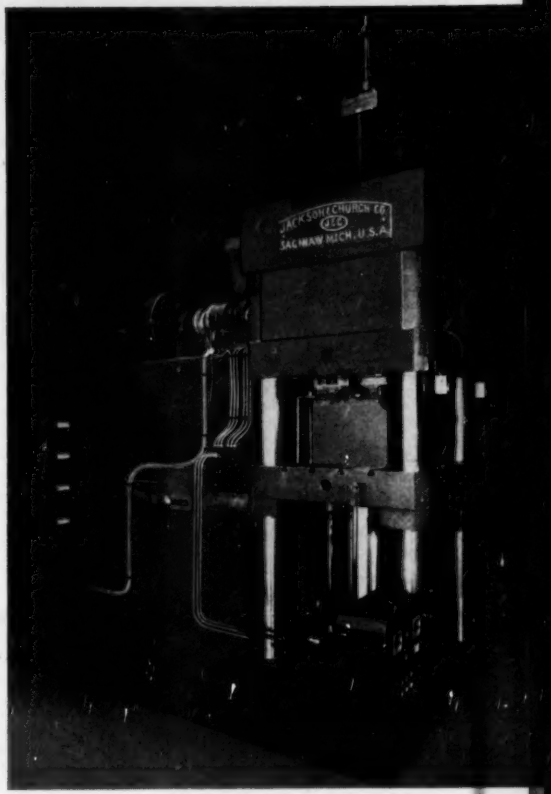
1. Conserves H.P. by using electric motor and pump from hydraulic unit as source of supply for fluid motor
2. Ease of maintenance of fluid motor
3. Relief valve works as brake to insure safety for other moving members
4. Ability to get minute speed variations
5. Ability to stop and start pre-plasticizing unit simply without ill effect.
6. Internal heating of extruder pump screw. Results in greater plasticizing efficiency

(4) HYDRAULIC UNIT

1. Self-contained
2. Automatically electrically controlled
3. Standard proven hydraulic equipment
4. All externally piped
5. All pumps vented to tank under no pressure during idle cycle

ADVANTAGES

1. Ease of maintenance (accessibility)
2. Venting pumps results in lower oil temperatures
3. Pressure gauges at all important locations to ease maintenance problems
4. Results in quiet operation
5. Fast, operation to insure minimum opening and closing time



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Time Cycle for 48 Oz.	30 Seconds
Total Poundage Per Hour	360 Lbs. (Styrene)
Pressure Per Square Inch on Material in Injection Chamber	10,000 p.s.i. Maximum
Diameter of Plunger	3¼" Diameter
Diameter of Screw	3¼" Diameter
Speed of Screw	25 to 200 r.p.m.
Projected Area	500 Square Inches
Locking Pressure	500 Tons 573 Actual
Stroke of Clamp Cylinder	27 Min. 36 Maximum
Speed of Closing	350 Inches Per Minute Slowed Down to 60 Inches Per Min. for Clamping
Speed of Opening	425 Inches Per Minute Slow Down for Knock-Out
Maximum Overall Height	19'6" to 21'
Maximum Daylight Opening	36" to 64"
Minimum Daylight Opening	0" to 37"
Distance Between Tie Rods	Left to Right 36 Inches Front to Back 36 Inches
Floor Space Required	96 Square Feet
Approximate Weight	60,000 Pounds

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

PRESERVATION OF AGRICULTURAL SPECIMENS IN PLASTICS. G. R. Fessenden. U. S. Dept. of Agriculture Misc. Publication *679*, 78 pp. (July 1949). Two improved practical methods for imbedding specimens in plastic are described. These are as follows: 1) Preservation of plant specimens by chemical treatment to retain their natural color and, after dehydration, mounting them in two-dimensional form in plastic plates. This method is applicable, with suitable modifications, to flowers, leaves, roots, and such other plant parts as lend themselves to being mounted in a flattened condition. 2) Embedment of three-dimensional specimens of biological material in blocks of transparent acrylic plastic. This method is limited to specimens that can be dehydrated without undesirable change in form or color and are not altered in appearance by the action of the plastic during embedding. Apparatus and materials needed and the techniques are described in detail. 158 references.

Materials

FLUORINATED PLASTICS. Brit. Plastics *21*, 457-65 (Aug. 1949). The synthesis, molding, fabricating, and properties of polytetrafluoroethylene, polyvinyl fluoride, and monochlorotrifluoroethylene resins are reviewed. Some of the recent progress in the chemistry of fluorine compounds is described.

Applications

IMPROVED SAFETY MOTION PICTURE FILM SUPPORT. C. R. Fordyce. J. Soc. Motion Picture Engineers *51*, 331-50 (Oct. 1948). Extensive experimental work on safety cine-film support has resulted in an improved product which offers possibilities for professional motion picture use. This product is a highly acetylated cellulose acetate with physical properties which are considerably different from those of ordinary commercial cellulose acetate previously used. Certain improved physical characteristics and improved aging properties of this base material are described in detail. As a cine-positive film support, the high-acetyl cellulose acetate is shown to give satisfactory behavior in printing, processing, and projection operations and compares favorably with present standard release positive film. Experimental studies on the use of the high-acetyl base for 35-mm negative film are described showing that this base will lend itself to use for negative materials. Particularly important is the fact that this base offers a very low degree of shrinkage on long-time storage.

Properties

DEGRADATION AND STABILIZATION OF POLYVINYL CHLORIDE. V. W. Fox, J. G. Hendricks, and H. J. Ratti. Ind. Eng. Chem. *41*, 1774-9 (Aug. 1949). The deleterious action of heat and light promotes changes in the color and physical characteristics of unstabilized polyvinyl chloride which are sufficient to prohibit its use in many applications. Although heretofore stabilization of polyvinyl chloride plastics has been an art, some supporting evidence is available to advance a hypothesis for this phenomenon. The individual effects of heat and light in inducing polyvinyl chloride breakdown are considered in detail. The contributing effects of plasticizers are treated as an important, although secondary, consideration in the ultimate heat and light resistance of polyvinyl chloride. A useful classification of plasticizers is suggested. The role of heat-degraded structures in the light stability of the polymer is indicated. The following ideal stabilizing system for polyvinyl chloride plastics is suggested: 1) agents capable of removing hydrogen chloride formed as insoluble products; 2) reactive molecules capable of breaking up color-producing polymer systems; 3) selective ultra-violet absorbers (screening agents) capable of reducing the total ultra-violet energy of incident light, and 4) antioxidants capable of inhibiting reactions initiated by the passage of unscreened ultra-violet light energy.

Molding and Fabricating

ELECTRICAL REQUIREMENTS OF PLASTICS MOLDING MACHINES ARE TOUGH. M. Morgan. Elec. Manuf. *44*, 102-6, 188, 190 (Dec. 1949). The problems involved in supplying electrical power, heat, and controls for plastic molding presses are described.

Testing

IMPACT TESTING OF PLASTICS: ELIMINATION OF THE TOSS FACTOR. B. Maxwell and L. F. Rahm. ASTM Bulletin No. 161, 44-7 (Oct. 1949). A new method is described for measuring the impact strength of polymeric materials which eliminates some of the extraneous energies measured by the standard Izod test, the most important of which is the energy to toss the broken half of the sample. The apparatus is described and the data for several materials both by the new method and the standard Izod method are tabulated. Comparison of results shows that this new method ranks materials in the proper order as indicated by service performance of the materials. Experiments are described which lead to the conclusion that the impact strength as determined by this new method is independent of the mass of the broken sample. This permits testing over a wide range of velocities.

Coatings

PRACTICAL FACTORS IN APPLYING INSULATING VARNISHES. M. Kronstein. Electrical Manuf. *44*, 96-101, 178, 180, 182, 184, 186, 188 (Dec. 1949). The formulation, application, and testing of electrical insulating varnishes are reviewed.

PETROLEUM-BASE PROTECTIVE COATINGS. W. H. Shearon, Jr., and A. J. Hoiberg. Ind. Eng. Chem. *41*, 2672-9 (Dec. 1949). The manufacture of protective coatings from petroleum is reviewed.

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THIS SPECIAL purpose rugged THERMEX model is designed for preheating dielectric materials such as large plastic preforms.

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Width	37 inches
Depth	37 inches
Height	88 inches
Work Level	37½ inches
Tray dimensions	28 x 35 inches
Net weight	2650 pounds
Electrode dimensions: (standard)	20 x 20 inches

Construction: *All steel construction with copper plating where necessary, totally enclosed*

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U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

HOT MELT COATING. M. Salo and H. F. Vivian (to Eastman Kodak). U. S. 2,481,687, Sept. 13. Composition consisting of cellulose ester, a high molecular ester, and chlorinated diphenyl.

RESINS. L. M. Minsk and W. O. Kenyon (to Eastman Kodak). U. S. 2,481,769, Sept. 13. Resinous ester prepared by heating isopropenyl acetate maleic anhydride polymer with *n*-hexyl alcohol in the presence of sulfuric acid.

SURFACE COATING. A. Barnes (to Polaroid). U. S. 2,481,809, Sept. 13. Scratch-resistant coatings of melamine- or urea-formaldehyde resin for thermoplastic elements.

COMPOSITION. J. S. Ross (to U. S. Rubber Co.). U. S. 2,481,879, Sept. 13. An aqueous mixture of dispersed polychloroprene and partially condensed resorcinol-formaldehyde resin and metal hydroxide catalyst which reacts to form a solid flexible material.

PRESSURE-SENSITIVE TAPE. P. F. Ziegler (to Kendall). U. S. 2,481,-895-6, Sept. 13. Pressure-sensitive tape containing adhesive mixture of polyvinyl chloride-acetate, an aryl sulfonamide-formaldehyde resin, and a phthalyl alkyl glycollate plasticizer.

SUEDE TREATMENT. D. T. Kirby and J. T. Chain (to Du Pont). U. S. 2,481,933. Sept. 13. Treating suede leather with an aqueous dispersion of polyvinyl acetate, butyl methacrylate, or chloro-2-butadiene-1,3 polymers.

TUBULAR ARTICLES. R. N. Sabee and C. S. White (to Sabee, Grady, Meroni, and Lilly). U. S. 2,481,951, Sept. 13. Depositing metal on a cathode, forming a plastic sleeve thereon and stripping the latter.

CELLULOSE ETHERS. J. H. MacGregor (to Courtaulds). U. S. 2,482,-011, Sept. 13. Mixing viscose and acrylonitrile under reaction conditions.

VINYL POLYMERS. S. Temple (to Du Pont). U. S. 2,482,038, Sept. 13. Adding sodium pyrophosphate or hexametaphosphate to an emulsion containing vinyl chloride polymer.

VINYL POLYMERS. T. V. Williams (to Du Pont). U. S. 2,482,048, Sept. 13. Adding an acid to an emulsion containing vinyl chloride polymer.

POLYMERIZATION. W. E. Elwell and A. L. Snow (to California Research). U. S. 2,482,056, Sept. 13. Polymerization process.

INTERPOLYMERS. G. W. Stanton and C. E. Lowry (to Dow). U. S. 2,482,073, Sept. 13. Interpolymers of vinylidene chloride, butadiene-1,3, and acrylonitrile.

LAMINATES. N. C. Foster (to Westinghouse). U. S. 2,482,086-7, Sept. 20. Fibrous sheets bonded with a copolymer of a vinyl monomer and the reaction product of an unsaturated acid and a drying oil.

RESIN IMPREGNATION. G. H. Chidester, P. K. Baird, G. E. Mackin, F. A. Simmonds, C. O. Seborg, M. W. Bray, and J. N. McGovern (to U. S.). U. S. 2,482,142, Sept. 20. Laminated impregnated cellulosic structure.

MOLD. I. Botwinick. U. S. 2,482,239, Sept. 20. Injection-molding of plastic buttonhole casings.

MOLDING. C. W. Burnham (to Fellows Gear Shaper). U. S. 2,482,243, Sept. 20. Injection molding device.

RESINS. D. E. Edgar (to Du Pont). U. S. 2,482,252, Sept. 20. Coating consisting of a diamine-dicarboxylic acid polyamide forming salt reacted with a dicarboxylic acid, a polymer of said combination, an alcohol, formaldehyde and urea, guanidine, and an amino triazine.

GLAZED RESIN. D. Gonda. U. S. 2,482,265, Sept. 20. Fibrous sheets impregnated with a thermosetting formaldehyde condensate and bonded together with methyl methacrylate resin.

POLYSILOXANES. J. F. Hyde and W. H. Dandt (to Dow Corning). U. S. 2,482,276, Sept. 20. A thermoplastic polysiloxane.

TRIPOLYMERS. C. J. Mighton (to Du Pont). U. S. 2,482,285, Sept. 20. Elastomer prepared by polymerizing 1,3-butadiene, styrene, and dimethyl (ethenylethenyl) carbinol.

PLASTIC PANEL. T. L. Hibbard and M. Jovanovich (to Ford). U. S. 2,482,339, Sept. 20. A plastic panel and mounting means therefor.

PROPELLER MOLDING. M. M. Sensenich (to Sensenich). U. S. 2,482,-375, Sept. 20. Method for manufacturing plastic-coated wood propellers.

POLYMERS. W. I. Weaver and L. M. Hobbs (to L-O-F). U. S. 2,482,389, Sept. 20. N-substituted aromatic sulfonamide polymers.

PHENOLIC RESIN. F. J. Nagel (to Westinghouse). U. S. 2,482,498-9, Sept. 20. Reacting a phenol, a monoaryl amine, a secondary diaryl amine, and an aldehyde, and laminates prepared therefrom.

MELAMINE RESINS. S. H. Rider (to Monsanto). U. S. 2,482,508, Sept. 20. Resinous heat reaction product of an alkyl ether of methylol melamine reacted with an alkyl ortho silicate.

RESIN. F. A. Sattler (to Westinghouse). U. S. 2,482,515, Sept. 20. A resin solution comprising a polyester amide resin dissolved in mixed solvents.

PHENOLIC RESIN. J. J. Wachter (to Westinghouse). U. S. 2,482,525, Sept. 20. The reaction product of phenol, formaldehyde and ethylene diamine.

POLYMER. D. E. Adelson and H. Dannenberg (to Shell Development). U. S. 2,482,606, Sept. 20. Polymer of polyallyl naphthenate.

POLYMERIZATION. C. G. Goebel (to Emery Industries). U. S. 2,482,761, Sept. 27. Heating a poly-unsaturated fatty acid in the presence of small amounts of water to prevent decarboxylation.

COPOLYMERS. J. Heerema (to Dow). U. S. 2,482,771, Sept. 20.

FORMULATIONS OF VINYL SHEETING STOCKS DEMONSTRATE THE SUPERIOR PERFORMANCE OF

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Emulsion copolymerization of vinylidene chloride and vinyl chloride.

PUTTY. J. L. Amos and E. D. Morris (to Dow). U. S. 2,482,825, Sept. 27. Putty comprising vinyl aromatic hydrocarbon, a catalyst, and a solid copolymer of styrene and divinyl benzene.

CELLULOSE ETHERS. A. S. Finlayson (to Hercules). U. S. 2,482,844, Sept. 27. Mixing preformed cellulose ether with cellulose, alkali, and an etherifying agent, and reacting to produce solvent-soluble cellulose ether.

CELLULOSE ETHERS. W. H. Myers (to Hercules). U. S. 2,482,862, Sept. 27. Heat stability of a solvent-soluble cellulose ether is improved by removing undesirable contaminating metallic cations and replacing with stabilizing cations.

ETHYLENE POLYMERS. L. Schmerling (to Universal Oil). U. S. 2,482,877, Sept. 27. Polymerizing ethylene in the presence of a peroxide to produce liquid polymers.

RUBBER BONDING. F. S. Perkerson (to Callaway Mills). U. S. 2,482,931, Sept. 27. Adhesion of rubber to fibrous material is improved by rubber latex containing salts of polyacrylic acids.

PROTOSCOPE. K. K. Golson. U. S. 2,482,971, Sept. 27. A self-illuminated methyl methacrylate protoscope.

TERPENE RESIN. F. W. Corkery and S. G. Burroughs (to Pennsylvania Industrial Chemical). U. S. 2,483,124, Sept. 27. Polymerizing terpene liquid by heating in inert solvent solution in the presence of acidic metal halide catalysts.

COPOLYMERS. A. M. Clifford (to Wingfoot). U. S. 2,483,182, Sept. 27. Copolymers of vinyl furane and chloroprene.

POLYMERS. C. E. Gleim (to Wingfoot). U. S. 2,483,194, Sept. 27. Polymers and copolymers of allylcarbamate.

SILOXANE RESINS. H. F. Lamoreaux (to G. E.). U. S. 2,483,209, Sept. 27. Partially hydrolyzing hydrocarbon-substituted chlorosilanes by adding water to a solution thereof in a polyether solvent and heating.

DECORATIVE. G. G. Rona (to Corona Enterprises). U. S. 2,483,236, Sept. 27. A decorative plastic trim for handbags.

SUITCASE HANDLE. G. H. Wheary, Jr. (to Wheary). U. S. 2,483,307, Sept. 27. A suitcase handle having a transparent plastic handle grip.

FABRIC BONDING. R. G. Bartlett, J. L. Moilliet, and R. J. W. Reynolds (to I.C.I.). U. S. 2,483,330, Sept. 27. Applying polyvinyl alcohol and urea-formaldehyde resin to an interliner for semi-stiff collars.

VINYL ETHER POLYMERS. C. E. Schildknecht (to General Aniline). U. S. 2,483,374, Sept. 27. Partially depolymerizing a flexible polyvinyl isopropyl ether by milling with benzoyl peroxide and interrupting when the desired viscosity is attained by milling in p-hydroxyphenyl morpholine.

FIBROUS PRODUCTS. C. S. Francis, Jr., (to American Viscose). U. S. 2,483,404-5-6, Oct. 4. Heating a plastic to the molten state, discharging in fibrous state into a gaseous atmosphere onto a retaining wall and causing to intersect and unite into an integral pervious web.

WIRE COATING. H. E. Smith (to Insl-X). U.S. 2,483,441, Oct. 4. Insulating coating comprising a cellulose ether, chlorinated diphenyl, dibutyl phthalate, paraffin wax, castor oil, triphenyl phosphate, and a solvent.

BOOKBINDING. C. C. Johnson (to Du Pont). U.S. 2,483,465, Oct. 4. A film of polyvinyl chloride and a surface sizing coat of a tripolymer of vinyl chloride, vinyl acetate, and an alpha, beta unsaturated carboxylic acid.

POLYAMIDES. S. J. Allen and J. G. N. Drewitt (to Celanese). U. S. 2,483,513-4, Oct. 4. Heating a polyamine containing two primary amino groups and secondary amino groups with oxalic ester until a fiber-forming polymer is formed.

PLASTIC SHEET. I. L. Lesavoy. U. S. 2,483,584, Oct. 4. Apparatus for treating the surface of plastic sheets.

COPOLYMER. T. S. Carswell and R. F. Hayes (to Monsanto). U.S. 2,483,753, Oct. 4. A copolymer of 2,5-dichlorostyrene and styrene.

ARTIFICIAL EYES. A. Kingston. U. S. 2,483,832, Oct. 4. Method for molding artificial eyes from plastic material.

CARBAMIDE RESINS. F. H. Snyder (to Snyder Chemical). U. S. 2,483,854, Oct. 4. Reacting urea, thiourea, and phenol with an excess of formaldehyde in the presence of an alkaline catalyst.

VINYL POLYMERS. M. Baer (to Monsanto). U. S. 2,483,959-60, Oct. 4. Heating aqueous slurry of polymers formed in the presence of maleic-vinyl acetate copolymer, with a salt, hydroxide, or oxide of lead, barium, or calcium.

POLYMERS. C. E. Barnes (to General Aniline). U. S. 2,483,962, Oct. 4. Heat polymerizable composition of N-vinyl pyrrole and stearyl alcohol stabilizer.

POLYSILMETHYLENE. J. T. Goodwin, Jr. (to Dow Corning). U.S. 2,483,972, Oct 4. Production of polymers from a halomethyl biaryl alkoxyl silane.

FIBERS. J. A. Calhoun, Jr. (to American Viscose). U. S. 2,484,012-3-4, Oct. 11. Extruding a solution of organic polymeric film-forming material capable of forming crystalline fibers into setting medium in presence of high frequency sound waves.

TUBE FORMING. F. V. Collins (to W. F. Stahl). U. S. 2,484,075-6, Oct. 11. Apparatus for forming tubes from fusible plastic sheet material.

CELLULOSE ETHERS. G. W. Seymour, B. B. White, and T. G. Davis (to Celanese). U. S. 2,484,124, Oct. 11. Cellulose acetate-laurate prepared by destabilizing a partially hydrolyzed cellulose acetate, dissolving in pyridine, adding lauroyl chloride and heating.

RESINS. N. C. Foster (to Westinghouse). U.S. 2,484,215-6, Oct. 11. A composition of styrene monomer and a half ester of castor oil and an anhydride of an olefinic acid; resin prepared by heating styrene with zinc isopropyl maleate.

RESIN. M. J. Scott (to Monsanto). U.S. 2,484,315, Oct. 11. A heat-curable reaction product of methylol melamine and 2-nitro-2 methyl-1-propanol.

VINYL ESTERS. C. J. Malm and L. D. Bearden (to Eastman). U. S. 2,484,415, Oct. 11. Reacting polyvinyl acetate having free hydroxyl groups with phthalic anhydrides and pyridine, and neutralizing with trisodium phosphate.

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NEW MACHINERY AND EQUIPMENT

POWDER MIXER-PREHEATER — Designed for small shops and for small injection and extrusion molding machines is the portable Tumble-Veyor, a combination mixer, dryer, and preheater of plastic powders manufactured by The Miskella Infra-Red Co., E. 73rd and Grand Ave., Cleveland 4, Ohio. Applicable to 2-, 4-, and (in some cases) 8-oz. machines, the unit is particularly adaptable to mixing colors to secure diversified effects. The Tumble-Veyor, which has a capacity of 10 lb. per hr., feeds hot thermoplastic granules directly into the hopper of injection and extrusion machines. In operation, the hinged tumbler mounting plate located over the hopper is tilted from its angular operating position to the automatic unloading position. The tumbler is then tilted back and refilled with fresh material which is mixed, tumbled, heated, and dried simultaneously until the preceding charge in the hopper is ready for more. As a result, heated material is always available. Motor drive consists of a 100-watt geared motor which turns the tumbler at the rate of 3 r.p.m.

VINYL, POLYETHYLENE EMBOSSER—A new embossing machine for unsupported vinyl or polyethylene film has been introduced by Frank W. Egan & Co., 108 Hamilton St., Bound Brook, N. J. Major features of the equipment are: a flat heating unit which enables film to be heated free of tension; the use of a small diameter engraved roll; and a rubber backing roll which can be used for any number of engraved rolls. Film is first placed on an unroll shaft and is threaded through a pull roll assembly. It is then delivered onto a stainless steel woven-wire blanket. While on the blanket, film is subjected to radiant heat provided by a surface-type heater and controlled by a percentage timer.

From the blanket, the heated film moves to the embossing section composed of an engraved roll and a rubber-covered roll, both temperature controlled by water cooling which helps "cold set" the film. As a result, embossing is said to be accomplished with considerably less pressure than is normally required. In the final phase, the embossed film passes around a cooling roll, after which it is wound up preparatory to shipment.

TESTING MACHINE—Development of an improved testing machine, Model 60-H, of 60,000-lb. capacity and with two ranges, has been announced by The Baldwin Locomotive Works, Philadelphia 42, Pa. Construction is such that the hydraulic loading unit is separated from the indicating and control unit. Additional highlights include: a rigid, two-column design which is said to give excellent accessibility in handling specimens and to simplify observations; high stability achieved by the distance between column guides and supporting screw in all positions of the elevating cage; and loading controls located on the table of the control cabinet which provide infinitely variable speeds between 0 and 2 in. per minute. The 60,000-lb. range is graduated in 100-lb. units on a 16-in. diameter indicator dial, while a 12,000-lb. range is graduated in 20-lb. units.

CONTINUOUS-FLOW MELTER — Equipped with a hopper which can store up to 200 lb. of granulated material, a new type of continuous flow melter has been announced by the Calresin Corp., 8564 Washington Blvd., Culver City, Calif. The melter, specifically designed to handle Plastiflex, a hot melt molding material, is capable of melting Plastiflex at a rate of up to 6 lb. per min. of continuous flow. The Magnaflow melter, as the machine is called, is provided with thermostatic control to eliminate the danger of overheating and burning. This control can be set at any pouring temperature desired between 300 and 400° F. Because of the special design of the machine, delivery of melted material at the desired temperature starts in approximately 8 minutes. The pressure-ejection principle is stated to make this speed possible. The machine is available in two standard models with custom-built models for large scale operations. Obtainable on special order.

TEMPERATURE INDICATORS—Two new thermometers have been added to its line of temperature indicators for industrial and laboratory use by General Electric Co., Schenectady 5, N. Y. Measuring temperatures up to 3000° F., the thermocouple thermometer is useful in industrial applications—galvanizing vats, melting pots, furnaces, and ceramic kilns. The resistance thermometers, designed for accurate recording of low temperatures up to 300° F., are used for generator- and transformer-winding temperature indication, refrigeration and air conditionng testing, drying operations, and all-around general and scientific laboratory work.

FLEXIBLE MOLD COMPOUND—A new flexible mold compound for plaster casting which is reported to be a vinyl hot-melt product, 100% reclaimable, has recently been placed on the market by Haas Process Corp., 211 E 4th St., New York 9, N. Y.

INJECTION PRESS—Molding of virtually all thermoplastics, including nylon, is possible on the new 2-oz. injection press, Model H-200, designed by The Van Dorn Iron Works Co., 2685 E. 79th St., Cleveland 4, Ohio. The press maintains up to 180 operating cycles per hour. Injection plunger and toggle mechanism are operated by hydraulic

NEW! VAN DORN 2-ounce Injection Press

Utilizing the same rugged construction with doubled capacity, this Van Dorn press now offers you more profitable production with molding time reduced 30% to 50%. The new press has a larger heating cylinder with more plasticizing capacity; greater injection pressure; faster cycling due to larger motor and pump; and a unit for cooling hydraulic oil.

Surprisingly low in price, this versatile press uses inexpensive molds, can be set up by one man in 20 minutes, and operates 8 hours for under 1 dollar!

With all these features, this remarkable press is *unequalled* in the 2-ounce capacity class for molding practically all thermoplastics, including nylon.

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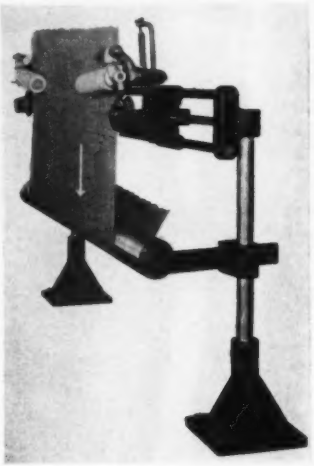
pressure developed on a pump driven by a 3-hp. electric motor.

Other features of the press include: plasticizing capacity of 12 lb. per hr.; maximum mold size of 8 by 10 in.; a casting area of 20 sq. in.; pressure of 10,000 lb. per sq. in. on material at the injection end; and a mold clamping pressure of 27 tons.

FILM-SHEET GUIDE—To keep plastic film and sheet materials moving in a straight line to or from processing operations, and in perfect alignment for uniform winding on rolls, a Precision Guider has been designed by



Mount Hope Machinery Co., 42 Adams St., Taunton, Mass. Material is guided by a tilting pair of nip rolls constantly under pressure to assure positive control. When the edge of material being wound tends to move laterally, it contacts and turns a grooved and fluted wheel which, through a slipping clutch, actuates the guiding function of the nip rolls.

VARIABLE SPEED POWER DRIVES—Flexible, positive regulation of speed for variations in processing or production operations is a major objective of Speed-Trol electric power drives manufactured by Sterling Electric Motors, 5401 Anaheim-Telegraph Rd., Los Angeles 22, Calif. Available in four types, this variable speed unit provides remote and automatic control. Positive pulleys are used which are claimed to result in minimum wear on pulleys, shafts, and belt, as well as to provide higher efficiency.

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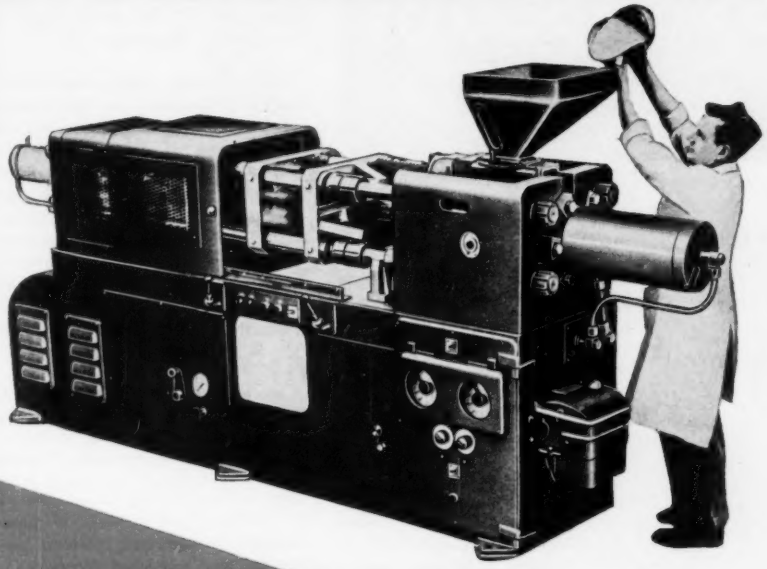

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The hydraulic system, powered by a 15 hp electric motor and a Vickers Balanced Vane Pump delivers 150 tons of evenly distributed clamping pressure and a total injection pressure of 44,000 pounds. Heat is provided by an external heater of 2500 watts, a nozzle heater of 100 watts and an internal heater of 250 watts. Important, too, all parts are accessible for easy maintenance.

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WINDSOR 4-OUNCE INJECTION MOLDING MACHINE

Die locking pressure	150 tons
Maximum molded	40 sq. in
Plasticizing capacity	25-35 lbs. per hour (approx.)
Pressure on material	13,850 lbs. psi.
Mold opens	9½"
Shots per hour	180 (max.)
Ounces molded per shot	4
Main motor	15 h.p.
Locking mechanism	multileaved toggle
Weight	3 tons (net)
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PLASTIC MACHINES

BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Boron Trifluoride and its Derivatives," by Harold Simmons Booth and Donald Ray Martin.

Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 1949. Price $5.00. 315 pages.

The rapid expansion in research on applications of boron trifluoride and its complexes developed a need for a comprehensive study in this field. This book presents a complete discussion of boron trifluoride and its derivatives using all available information as of January 1948 to facilitate investigations in this field. The physical and chemical properties and the coordinating power of boron trifluoride are discussed along with fluoboric acids, their salts, and the use of boron trifluoride and its complexes as catalytic agents. Also included is an extensive bibiography referring to all articles containing information on this subject, much of it indexed here for the first time.

"Sugar Derivatives: A Survey of Potential Production Costs." Technological Report Series No. 6, by Harold E. Bode.

Published by the Sugar Research Foundation, Inc., 52 Wall Street, New York 5, N. Y. 36 pages.

This booklet will be of special value to industrial chemists interested in exploring the potential market for non-food uses and new commercial products obtainable from sugar derivatives. In tabular form, the publication presents the probable costs of production of a number of sugar derivatives, confining its analysis to those items which can be produced at less than $1.00 per pound. Also included is a brief resume of how each derivative is prepared.

"U. S. Industrial Design 1949-1950," by Members of the Society of Industrial Designers.

Published by The Studio Publications, Inc., 381 Fourth Ave., New York 16, N. Y. Price $10.00. 186 pages.

Each contributing designer has selected examples which he considers typical of his recent work, and has presented them in text, illustrations, and page layouts prepared by himself. The examples are grouped under seven subject headings, such as household equipment, transportation, industrial apparatus and machinery, etc. Taken as a whole, the compilation is an impressive presentation of the recent achievements of the authors, and the photographs are generally excellent. However, the book generally suffers from a paucity of text. In some cases, the designer even neglects to mention whether the product is made of plastics, aluminum, steel, or wood. The book is the first of a planned series.

"The Strength of Plastics and Glass," by R. N. Haward.

Published by Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y. 245 pages. Price $5.50.

The experimental work that has been done on the static strength, deformation, hardness, and impact strength of different types of plastic materials and glass is described. Due to the fundamental nature of the problems discussed, the book should have wide appeal for those interested in the general properties of matter, the interrelation of mechanical properties, and the experimental and mathematical techniques of their investigation. Numerous diagrams show in graphic form the results of work done in different countries on this subject.

Preservation of agricultural specimens in plastics (Miscellaneous Publication No. 679)—Two methods of preserving agricultural specimens in plastics are discussed in this 79-page booklet: mounting two-dimensional plant specimens on vinyl sheets for color retention, and embedding three-dimensional objects of biological material in methacrylate plastic blocks. The necessary equipment, preparation of specimens, and finishing processes for both of these procedures are also included. All the steps are fully illustrated. *U. S. Department of Agriculture, Washington, D. C.*

Vinylite resins and plastics—The forms, properties, and applications of Vinylite resins and plastics are summarized in this revised and illustrated 42-page booklet. The various types of the material are discussed separately, with an up-to-date listing of their more important applications. A partial listing of uses, broken down topically, is included along with nine tables of properties. *Bakelite Corp., 300 Madison Ave., New York 17, N. Y.*

Catechol (Technical Bulletin C-9-127)—A new 28-page technical bulletin describes the uses, chemistry, and properties of catechol. Applications of catechol to photography; to dyes and fur dyeing; as antioxidants for rubber and plastics; in pharmaceutical products; and in perfumery are considered. *Koppers Co., Inc., Pittsburgh 19, Pa.*

Case of the metal that was caught—Design and operation of the Allis-Chalmers metal detector are described in this 20-page bulletin. An electronic sentry, the detector protects non-metallic products by signalling the presence of any metallic particles. Dimensional specifications of the four available models are given. Pictures illustrate the unusual applications of the machine and some of the detected material. *Bulletin 14B7217A, Allis-Chalmers Mfg. Co., S. 70th St., Milwaukee 1, Wis.*

Fork trucks and tractors—The full line of Clark fork-lift trucks and towing tractors is covered in this 8-page bulletin. Dimensional specifications of both the gas-powered and electric models are presented in tabular form, along with comparative data on the various machines. *Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.*

Panelyte, a new design for living—Panelyte Cameo, a laminated plastic-surface material for horizontal and vertical interiors, is introduced in this 4-page illustrated folder. The properties and uses of the material are described. Featured is a chart of the seven colors in which the

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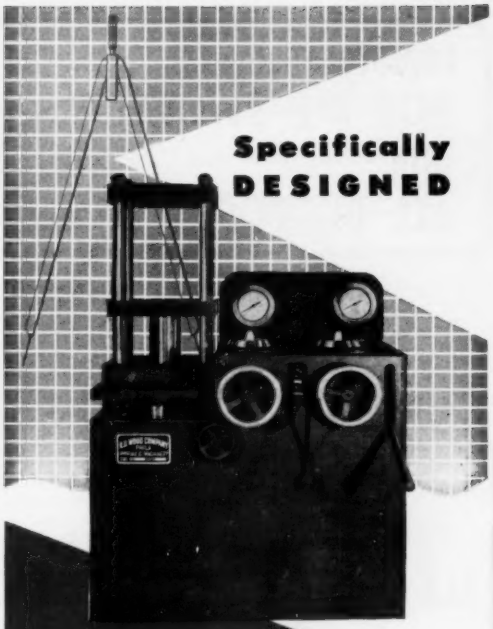

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Package steam generators—Components, design, and properties of the company's line of package steam generators are set forth in this 12-page booklet. Included are diagrammatic dimensional drawings of coal-, oil-, and gas-fired generators in various models, along with diagrams of firing arrangements for these machines. *Foster Wheeler Corp., 165 Broadway, New York 6, N. Y.*

Products and services for industry and agriculture—This 64-page revised and illustrated booklet briefly describes the products and services which the company offers, and outlines the divisional structure through which such products are sold. *American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.*

Care of nylon—Presenting techniques in the care of nylon, this 8-page booklet is issued as part of an educational program on nylon fibers. The instructions cover washing, bleaching, bluing, drying, ironing, cleaning, and storage of nylon. *E. I. du Pont de Nemours & Co., Inc., Nylon Div., Wilmington, Del.*

Research projects—Over 4000 current college and university research projects in engineering are listed by title in the 1949 "Review of Current Research." The text discusses the administrative policies at each institution, and lists the responsible personnel, research expenditures, etc. For reference purposes, a complete index is included together with a breakdown of research projects according to the engineering departments involved. *180 pages. $1.75 postpaid. F. M. Dawson, Chairman, College of Engineering, State University of Iowa, Iowa City, Iowa.*

Applications of induction and dielectric heaters (Catalog No. H-200-S)—The principles of induction and dielectric heating are explained in this 11-page booklet, together with the advantages of a high frequency heating system with Elenco machines. Included is a list of the proved applications of both induction and dielectric heaters. A table

of standard specifications summarizes the company's line. *Electronic Engineering Corp., 624 Ridge Rd., Lyndhurst, N. J.*

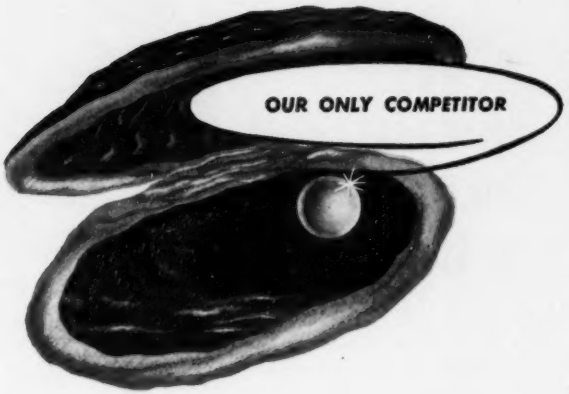
Management problems—This complete catalog to the publications of the American Management Assn. covers pamphlets of interest to the executives in the fields of personnel, production, office management, general management, etc. *American Management Assn., 330 W. 42nd St., New York 18, N. Y.*

Material handling—Equipment for industrial material handling at the machine is illustrated and its uses are described. The "positioning" phase of material handling, which warrants careful study by industrial executives, is discussed and graphically illustrated with charts and diagrams. *Lyon-Raymond Corp., Greene, N. Y.*

Isopropenyl acetate—Outlined in this four-page bulletin are the chemical properties of isopropenyl acetate, including such characteristic reactions as enol acetylation, halogenation, pyrolysis, polymerization, and reactions with alcohols, amines, and acids. The physical properties of the material are presented in tabular form. *Tennessee Eastman Corp., Kingsport, Tenn.*

Fine screen strainers (Yarway Bulletin S-202)—Pressure and screen data tables are brought up to date in this revised four-page bulletin. The protective value of strainers for pipe line equipment is explained, as well as the special features of Yarway screwed strainers. Accompanying the text and tabular matter are photographs of the various units in the company's line. *Yarnall-Waring Co., Chestnut Hill, Philadelphia 18, Pa.*

Web material handling—The general principles in handling operations involving flexible and continuous strand or web materials such as wire, monofilaments, tubings and films are dealt with in this 20-page booklet, "The Handling of Webs and Monofilaments," by C. A. Litzler. The text is supplemented with drawings and photographs illustrating the general considerations. *Industrial Ovens, Inc., 13825 Triskett Road, Cleveland 11, Ohio.*



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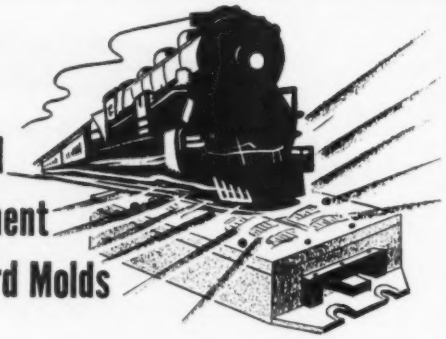

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London Letter

News and Notes on Trends in the Manufacture and Application of Plastics in Britain

The 1951 Festival of Britain, held to celebrate the centenary of the famous Great Exhibition of 1851, promises to be of considerable importance to the British plastics industry. Although this is a Government-sponsored and organized affair, the plastics industry will be asked to contribute a large amount of material for the interior decoration of pavilions. A good deal of interest is being shown by the trade in inquiries now being made by Festival Authorities for the supply of five million molded cups and saucers, half in acrylic and half in melamine. In 1951 there may be a British National Plastics Exhibition in London and also an International Plastics Convention organized by the trade paper, *British Plastics*.

The Redux process, developed by Aero Research Limited, Duxford, Cambridge, for binding metal to metal and metal to wood is now being employed on a large manufacturing scale by Venesta Ltd. for veneering aluminum to wood. The composite material Vendura is finding uses in building construction.

Expanded polyvinyl chloride is now being fairly widely used for upholstery. It is free from any rubbery smell, is lighter in weight, and ages better than rubber. Polyvinyl chloride latices for coating and dipping applications in the textile industry are also coming to the fore. Prominent in this specialized field are I.C.I. and British Geon Ltd., both of which market latices. Hindering British progress in the large-scale development of polyvinyl chloride is a shortage of plasticizers, particularly the newer adipates, and the high purchase tax on p.v.c. finished products.

Polystyrene sheet may be made available in Great Britain during 1950. This is sure to find immediate applications in the fancy goods field where the price of acrylic sheet is too high for the cheap store trade. Output of styrene is increasing. Petrochemicals, Ltd. has just announced that four out of five fur-

naces at its Manchester factory are now working on the conversion of straight chain hydrocarbons from the oil refinery to cyclic compounds, such as styrene.

Calendered polyvinyl chloride thin sheeting is now becoming more popular and large London stores report increasing sales of the sheeting, as well as made-up garments. Unsupported p.v.c. calendered sheeting for upholstery purposes is challenging supported material; the former is made in thicknesses of 0.012, 0.016, 0.018, 0.022, and 0.026 in. and widths of 36 inches.

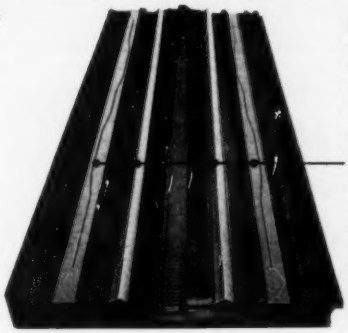
Availability of more polyethylene in 1950 focuses attention on the paper-coating process, the Cinderella of British Polythene fabricating methods. One important possible outlet for polyethylene-coated paper is the manufacture of milk containers, the market for which runs into many millions a day. So far, the use of polyethylene-coated paper has been confined to the packaging of tobacco for export, mainly because of the poor supply position.

A good deal of controversy centers around the use of acrylic sheeting in exhibitions in London. The London County Council, which licenses all the exhibition buildings in the capital, insists that no flammable material may be used in the construction of stands. It classes acrylic sheet as "highly flammable", literally bans its use entirely for constructional purposes, and permits it to be employed only on a very limited scale for display purposes at the discretion of its inspectors. Before any large exhibition opens in London, all stands are scrutinized to discover "fire-raising" acrylics. In some cases the promoters of exhibitions acting on behalf of the exhibitors have refused point blank to relinquish offending acrylics and in such cases the L.C.C. has usually adopted a more conciliatory attitude.

—*John S. Trevor*

CORRECTION

The name of Chicago Molded Products Corp., molder of washing machine agitators, was omitted from the article on page 183 of our January issue. This company was the original molder of the Meadows agitator.



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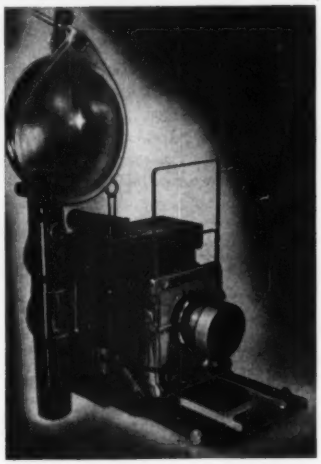


Flash shield of vinyl or cellulose acetate fits almost all reflectors

A SHIELD to eliminate the danger of exploding photo flash bulbs is now being fabricated of transparent vinyl or cellulose acetate sheet. The shield, which is manufactured by Central Tool Co., Hartford, Conn., is made in two sizes to fit almost all types of reflectors.

The dome-shaped shield is die-formed of 0.020-in. thick sheet stock and has a glossy finish on the inside surface and a mat finish on the outside. Thus it diminishes "hot spots" by diffusing the light.

Clear acetate or Vinylite sheet is used to make a shield for black-and-white work. Blue-tinted shields are made for color work, and are said to permit use of ordinary bulbs (instead of blue) with color film.

Nathan-Adler Associates, New York, designed the shield which snaps on to a fitting that can be left permanently attached to the flash reflector. The small size shield, which is 5½ in. in diameter, weighs less than 1½ ounces. It can be swung around on its single snap fitting whenever a bulb change is necessary. The larger shield, designed for professional type cameras, is 7 in. in diameter.

The light-weight, flat, virtually unbreakable shields present no new storage or transportation problems to gadget-laden photographers.

Left: Plastic signalling device summons waitress when flag is upright. Below: Signal base and arm are of phenolic or urea—flag and release button are of polystyrene

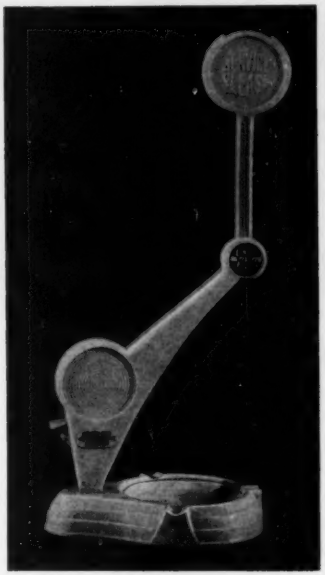
Service Signal

ARM-WAVING and finger-snapping to get the waitress are unnecessary when the table is equipped with a Servette Service Signal, a new plastic device which enables diners to call the waitress by merely pressing a button. The unit is made by Servette, Inc., Fort Worth, Texas,

The Servette signal consists of a base and an upright signal arm with a release button on it. When the button is pressed, a signal flag of a contrasting color (normally in the arm) springs upright.

The five plastic parts of the signal unit were designed and are produced by Lone Star Plastics Co., Inc., Fort Worth, Texas. The base and the two halves of the signal arm are transfer molded of maroon Bakelite phenolic in a 6-cavity die with integral pot and plunger. For ivory-colored models of the unit, these parts are molded of Beetle urea in the same die, run as a straight compression mold. The signal flag and the release button are molded of red or yellow Styron polystyrene in a 4-cavity die. Both molds used were made by Libbert Tool & Die Co., Fort Worth.

An ash tray depression is molded-in to the base piece, and a glass liner is furnished with the unit for ease of cleaning. The stationary upright arm has a molded-in circular depression to accommodate snap-in cards on which the daily special can be typed, or hand-written.



Plastic Femur

CLAIMED by surgeons to be the first successful operation of its kind is a polyethylene femur inserted into the hip joint.

This latest surgical application of plastics occurred at the Royal National Orthopaedic Hospital, London, England, where a patient was suffering from a disease of the leg bone. If this operation had been carried out in the usual way, it would have been difficult for the patient to walk. However, with the plastic bone, the stump healed and the patient walks normally.—*John S. Trevor*

Polyethylene bone used in hip joint permits more efficient leg surgery

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The constant pull it supplies is your guarantee against bunching of the film or decreased gauges caused by insufficient tension or by tension that is too great.

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IN ANY FILM FABRICATING OPERATION

Coupled to the Progressive Tension Unit in the illustration is the Progressive Automatic Batcher (Model #103).

As the plastic film comes from the tension unit, or from a printing press, calender or embossing machine, the Progressive Automatic Batcher automatically winds pre-determined lengths onto cardboard tubes.

FULLY AUTOMATIC

The magazine of the batcher is loaded with tubes and the desired number of yards per tube is set on the controls. Without attention, other than supplying additional tubes, the Automatic Batcher will wind the desired yardage, cut off the film and start winding on a new tube!

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Flexible acetate earpieces on sunglasses ease fitting and reshaping

Sunglass Frame

FLEXIBLE adjustability of temple shafts of sunglasses has been achieved by Columbia Protektosite Co., Inc., which is preparing to present its new developments to the U. S. market. Adapted from a design which was originated in Italy, the new glasses feature a strong, flexible metal insert molded as an integral part of the slotted Lumarith acetate earpieces. As a result, consumers can have their sunglasses custom-fitted upon purchase—and can reshape the glasses whenever needed.

Slots in the cellulose acetate frame penetrate almost to the surface of the metal insert, enabling the insert to adjust itself freely to skull shapes. This factor reduces danger of breakage, while the corresponding feature of the ear grips provides both comfort and safety.

Columbia's Lumarith frames are available in solid or two-tone colors. The cellulose acetate hues include shell; clear flesh, red, and blue; pearloid blue, red, and pink; and pastel blue. The lightweight glasses are merchandised in a plastic carrying case, and vary in price from $1.00 to $2.00 depending upon the type of hinges and lenses selected. Sales efforts for this latest development in optical design will be directed primarily toward the Winter beach market.

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To obtain any of the booklets or catalogs listed below, simply circle the corresponding number on the post card, fill in the information requested, and mail.

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Specification and data sheets covering the use of offset printing equipment for decorating plastics in both odd and regular shapes. Apex Machine Mfg. Corp. **(2-600)**

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Booklet describing the construction of lampshades from Crinothene polythene sheet. Illustrations are given for an easier understanding of the steps involved. 16 pages. Imperial Chemical Industries Ltd. **(2-601)**

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Features and advantages of Farlite decorative plastic sheets used for table tops, counter tops, paneling, and wainscot are presented. A chart showing the various colors and designs is also included. 4 pages. Farley & Loetscher Mfg. Co. **(2-602)**

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Guide to Cycopol resins, Beetle resins, Melmac resins, Rezyl resins, Phenac resins, and Teglac resins. 4 pages attached to a calendar. American Cyanamid Co. **(2-605)**

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Data on the Plastiversal and Lo-Cap Universal Testing machines for plastics is given. Various other small testing machines are also described. 32 pages. Tinius Olsen Testing Machine Co. **(2-615)**

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Technical report showing properties, instructions for use, and ordering information for G-E No. 12517 adhesive. General Electric Co. **(2-616)**

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RESIN
The properties, solubility, compatibility with drying oils, etc. of Durez 220-V resin, a terpene phenolic, oil-soluble, high-melting, high-viscosity, thermoplastic resin. Important information on its uses is included. 8 pages. Durez Plastics & Chemicals, Inc. **(2-618)**

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General catalog of Baldwin equipment for process industries—various types of steam platen presses, plastic molding presses, etc. 12 pages. The Baldwin Locomotive Works. **(2-630)**

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Technical bulletin containing table of properties of Koppers general purpose polystyrene 7 and Koppers lubricated polystyrene 3. Koppers Co., Inc. **(2-632)**

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Illustrated bulletin giving details of design and construction, sizes and capacities, applications, and performance advantages of Banbury mixers. 32 pages. Farrel-Birmingham Co., Inc. **(2-633)**

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24-page illustrated catalog listing machinery used in die and mould production. Specifications and information on the various features of each machine are provided. J. Arthur Deakin & Son. **(2-646)**

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Fabricated of ¼-in. thick Plexiglas by the Art Guild, Philadelphia, Pa., for the Embree Mfg. Co., Elizabeth, N. J., the plastic bottle weighs 70 lb. and contains 260 lb. of Wipe-On, a liquid surface finishing and protective material.

The bottle is molded in two sections on wooden dies and assembled by means of a special solvent. The solvent softens the edges of the bottle and the halves are joined together while the edges are still soft. To provide added strength, plastic reinforcing tabs are incorporated at several points along the joint.

To relieve the tremendous pressure on the bottle, a drop-out panel is inserted behind the label. Although the panel contains no liquid, the weight of the filled bottle still exceeds 300 pounds. It is estimated that without this panel, the total weight of the filled bottle would have been between 400 and 500 lb. —enough to cause bursting.

The giant acrylic bottle, which is backlighted when on display, is making its appearance at various hardware and houseware shows throughout the East and Midwest.

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Candy Bank of Polystyrene and Acetate

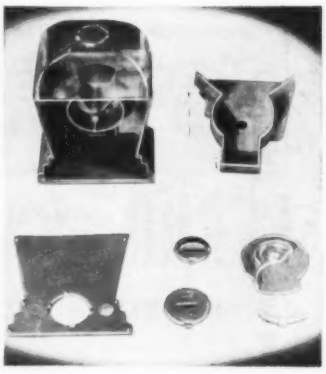
A CHILD'S candy bank, which features an all-plastics mechanism so designed that a coin must be inserted before the candy can be obtained, is now being molded of polystyrene by the Tech-Art Plastics Co., Inc., Long Island City, N. Y., for Selco Novelty Products, Inc., Long Island City, N. Y. The toy is marketed through chain and department stores and is advertised in toy trade papers.

The toy, known as the Candy Mart Bank, consists of 10 injection-molded parts. These parts include a housing, an internal partition, a coin lock, a candy lock, a knob, a drum, a pack plate, a dome, a regulator, and a lever. An eleventh plastic part is a window fabricated from cellulose acetate sheet stock. Tech-Art uses three molds, which contain a total of 20 cavities, for the 10 polystyrene parts. Two of each piece are molded in one shot. Close tolerances had to be provided for and maintained on these parts to insure proper action of the mechanism.

The assembly of the parts, which requires only 50 sec., is performed by Selco. First, the lettering is hot-stamped on the housing and drum. Then the window is glued to the inside front of the housing, the lever inserted in the partition, and the regulator slid over a lug in the partition which locks it in place. The lever, which also fits over a lug, lies in position below the regulator. Next, the partition is slid onto a cam in the housing and is held in place by a protrusion on the drum that is inserted through a hole in the housing. The knob is then glued to the protrusion, thereby holding the partition in place. The dome, which is the only visible transparent polystyrene part, is slid over the top of the housing cam. The back plate with the attached coin lock is then glued to the housing (six small lugs in the back plate engage corresponding holes in the housing), the dome filled with candy either by machine or hand, and the candy lock put in place.

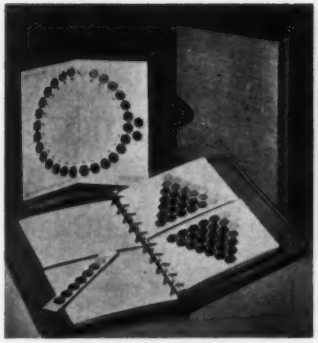
Polystyrene bank is made in three molds having a total of 20 cavities

Plastic bank has 10 injection-molded parts. Assembly time is 50 seconds. Bank can be refilled.



The Candy Mart Bank will take any coin from a penny up to and including a quarter and will dispense bubble gum, candy, peanuts, etc., depending upon the likes of the parents.

When the coin is dropped into the coin slot, it hits the lever and unlocks the regulator. At this stage the knob for the drum, which has a one-sixth section cut out of it, can be operated so that the drum will be turned upwards to receive the candy. The drum is then turned back to normal position, the plastic mechanism returns to locking position, and the candy is delivered through a slot in the base of the housing.



Cellulose acetate color chips are clear, durable, and easily printed

Color Manual

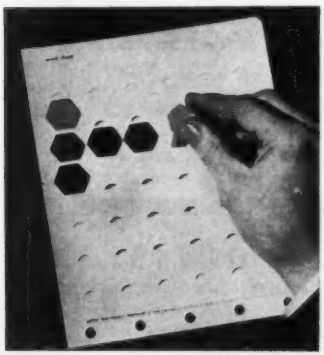
TRANSPARENT cellulose acetate sheet material is used to make the 943 hexagonal color chips which constitute the heart of the 3rd edition of the Color Harmony Manual now being distributed by the Color Standards Dept., Container Corp. of America, Chicago, Ill. The acetate material is used because of its clarity, durability, and ease of fabrication and printing.

The Color Harmony Manual is a modern presentation of the fundamental color system developed some years ago by Dr. Wilhelm Ostwald. It is used to establish color-control programs and to work out color harmonies.

The manual consists of a series of hue charts, in each of which there are 27 of the color chips, geometri-

(*Continued on page* 129)

Plastic chips are sprayed with special lacquers to obtain desired hues



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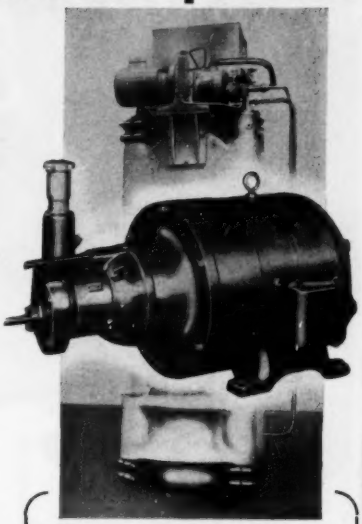

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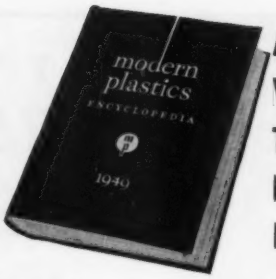

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cally arranged in accordance with the principles set forth by Dr. Ostwald. There is also a hue circle with 30 color chips, a gray scale of white-to-black chips, work charts, and a text explaining the manual's use.

Unusually close control of color application was required in the production of the plastic chips, which are made of clear, transparent cellulose acetate sheet produced by Monsanto Chemical Co.

The sheets were prepared by spraying a pigmented lacquer of appropriate color on the clear acetate material. Pigments of maximum permanence were employed in a vehicle also composed of cellulose acetate. Pigments used included cadmium reds and yellows, phthalocyanine green and blue, ultramarine blue, vat purples and reds, and black and titanium dioxide white.

Formulation and spraying of the acetate sheet color chip stock was carried out by Carl E. Foss, Princeton, N. J., who is co-author of the manual with Egbert Jacobson and Walter C. Granville of Container Corp. M. G. Boas & Son, Chicago, printed the acetate sheets.

Phenolics

(*Continued from page 58*)

lic toilet seats have been standard industrial equipment for years. There seems no reason why they wouldn't be acceptable in all other fields if dressed up with a brightly colored baked-on surface coating.

Gilt or gold plated coatings could also be easily and much more widely used for such things as buttons, knobs, escutcheons, etc. There are almost no phenolic door knobs in this country, but, together with escutcheons, they form one of the largest outlets for British phenolics. A few years back, phenolic radio dials that had molded-in graduations filled with white paint were common. This technique could be broadened to apply to other fields. There are thought to be scores of applications where small phenolic pieces can do a job thermoplastics and other materials can't touch.

While considering small pieces, it may be significant to note that phenolic closures made a big come-

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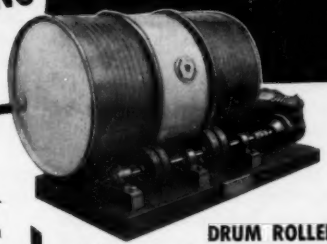
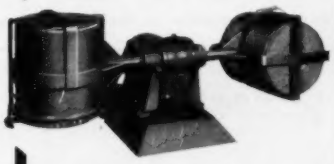
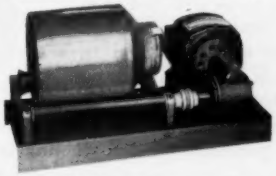


● Our own plastics division, fabricators of Tygon and Duralon plastics, as well as other plastics manufacturers, have found these versatile, inexpensive units ideally suited to effective low cost mixing, grinding and blending of molding powders, pigments, stabilizers, plasticizers, etc. They simplify material handling as well as processing.

DRUM ROLLERS
Roll any round container from a 5 gallon pail to a 70 gallon drum. Permit mixing in suppliers' drums, eliminating necessity of transferring contents to fixed mixing units. "U. S." Drum Rollers will handle loads up to 500 lbs. per drum. Available in sizes to handle 1, 2, 3 or 4 drums. Fixed or variable speed units.



PAIL TUMBLER Designed to tumble 5 gallon round pails or fibre containers at a tumbling speed of 16 RPM. This lightweight (only 75 lbs.) compact unit has quick-opening, positive-locking clamps to speed up loading and unloading.



● Write for this free catalog on Mixing and Grinding Equipment. It points the way to better, lower cost mixing, grinding or blending of molding powders, pigments, etc. Ask for Bulletin 260.

JAR MILLS — "U. S." *roller-type* jar mills are tops for mixing or grinding small batches of materials (wet or dry). Adjustable units will handle any round container from 3" diameter to 15", up to 12" in length (roughly 1 quart to 6 gallon capacity). Special patented roller design prevents jar creepage.

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back last fall. The closure users found that phenolic's stability alone was a property they couldn't give up despite the glamour appeal of thermoplastics; and the speed with which thermoset closures can be turned out on automatic presses, plus the low cost of phenolic, will probably make them economically supreme for years to come. About 20 million lb. of plastics is used annually for closures.

A further possibility for semi-glamorization of phenolics is a practice of years ago which has been almost abandoned but that might well be revived. The purpose is to give a different surface finish than the customary shine by designing the mold to provide a corrugated, sand blasted, or dull finish on the molded item. In furniture, switch plates, dials, knobs, etc., this type finish is often preferable to the glossy finish now most prevalent. The molders may profit from the experience of vinyl sheet processors whose success in marketing their product is due in great measure to the printing and other surfacing techniques applied to their material.

Another possibility in developing increased use for phenolic molding powder is in combination with rubber. Progress has been disappointingly slow but seems assured in the near future. The largest volume of this material today goes into shoe soles made from nitrile (Buna N) rubber and phenolic. GRS and natural rubber are also used in combination with phenolic for the same purpose to produce a less costly but not quite so good sole. Another formula using 70 parts resin, 30 parts Buna N, and 100 parts filler without any addition of sulfur and which cures in 5 to 10 min., gives a material similar to Ebonite, a natural rubber compound which takes 30 to 60 min. to cure. Other compounds of the rubber-resin mixture are being used for tool handles, plugs, grommets, and floor tile.

Other phenolics aside from molding powder showed no spectacular gains in 1949. Laminating resin held about even. Neither industrial nor decorative laminates gained much ground in the struggle for new markets. High cost and a decline in electrical equipment purchasing no doubt held back any advance.

Adhesives improved, largely because of their increasing use for outdoor plywood. Phenolic and resorcinol glues are almost certain to show constantly increasing volume in the furniture and plywood industries because of their moisture and weather resistance.

Miscellaneous Resins

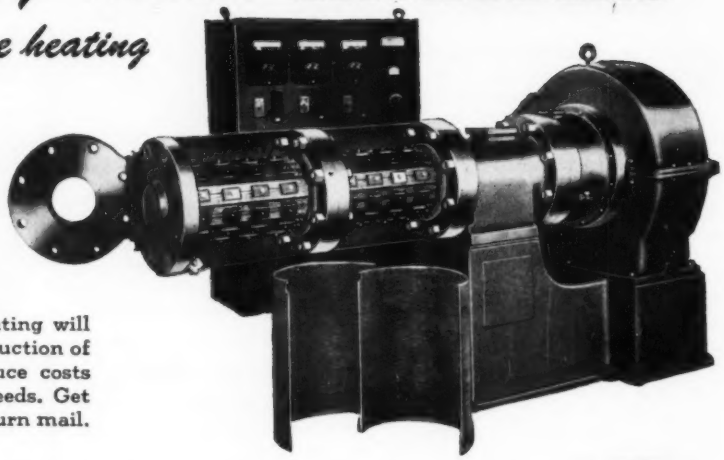
The reason for a decline in miscellaneous phenolic resins is obscure. One company has ceased production, but that still doesn't explain the total decline. Casting resin has declined to around 90,000 lb. a month from a high of about 600,000 pounds. Binder for Rock Wool is estimated to be running at some two million lb. a month liquid, or 1,400,000 lb. solid. Resins for abrasives and brake linings hold about even, but not much more than one million lb. a month can be counted in that listing.

The use of resin for bonding wood waste is making haste slowly. The process is still in a developmental state and the problem of bringing equipment and supply together in one location has not yet been whipped. Perhaps a lot of headaches will be saved if the industry continues

(*Continued on page 133*)

Electrically Heated **EXTRUDERS**

for accurate zone heating



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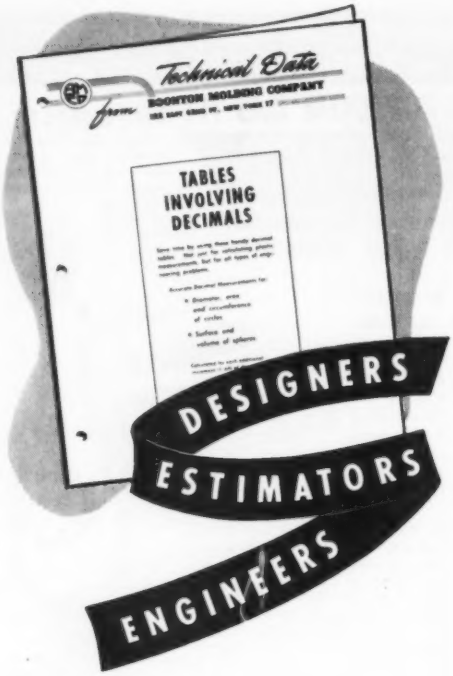

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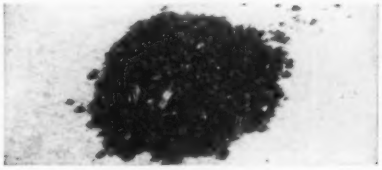

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to develop slowly. So far, the principal use of bonded wood waste has been for doors, panels, drawers and backs for furniture.

Engineering problems of no small magnitude are involved in this promising development. Today major attention is focused on curing of wood waste board, but one authority says properties are far more important and must be upgraded. Too many operators are attempting to get by with as little as 2% resin content, he says, when at least 5 or 6% should be used, and some of the earlier operators have now gone to 15 percent.

What this miscellaneous list of phenolics will eventually contain is difficult to imagine. All producers are working on new types that show promise of remarkable results. The Armed Services are particularly concerned about several of them.

Incidentally, that phenolic rivet mentioned here last year is still a probability. It will be made from a new, tough, flexible casting type resin that cures at room temperature; but the engineering difficulties involved in the resin's development and production are still unsolved.

Vinyl

(*Continued from page* 61)

The growth of vinyl coating on paper did not expand as much in 1949 as expected, but expansion is by no means stymied. The use of vinyl-coated paper as a replacement for oil cloth failed to develop when the latter became more available, and its expected expansion in paper drapes didn't materialize when thin-vinyl film stole a large part of that market. The use of vinyl-coated paper as shelf covering, for decorative effect and protection, has not even begun to come into its own. Big volume use is assured in a new 1949 product, vinyl-treated paper milk bottles, which can be shipped in flat sheets. Vinyl latex has also moved into the field for wide use by paper companies, but they have not as yet divulged their operations in this line. Vinyl latex is also being employed as a coating for the carpeting used in trunk compartments of automobiles, to help preserve Christmas trees, as a vehicle for agricultural chemicals, and often as a light finish on fabric before it is coated with plastisol.

The molding and extrusion division of the vinyl industry ran behind 1948 in volume until June of 1949, but the last six months increased enough to bring total volume ahead of 1948. The reason was that the wire and cable industry, which uses about 60% of all vinyl and extrusion compound, had a severe set-back in the first part of 1949. However, this percentage of the whole is continuously decreasing because other products are taking greater amounts of vinyl extrusion compound.

Next largest usage of extrusion compound is in garden hose. Some 50 million ft. requiring about 6 million lb. of compound were produced in 1949. That is a 100% increase over 1948, but not nearly as big as it is going to be in a few years. Over 240 million ft. of all types of garden hose were manufactured in 1949, and vinyl is destined to obtain a much bigger percentage now that the old-line rubber-hose people are getting into vinyl production. Then there is the development of a braided rubber-cord hose coated with a vinyl jacket, made to sell at a slightly higher cost than straight vinyl,

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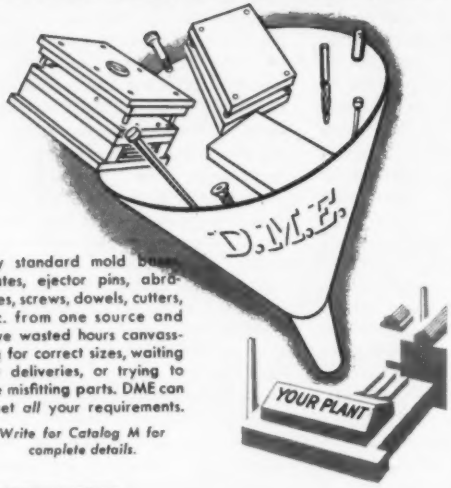

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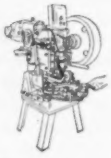

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which could result in a slightly lower vinyl poundage use. Most authorities, however, think it will broaden the market by adding another line.

Belting for apparel use and welting for automotive use, furniture, and shoes come next in order for extrusions, but the total consumption of vinyl here is still low in comparison to the above-named products. Many miscellaneous extrusions such as gaskets for aluminum windows and for washing machines are growing in variety and poundage.

Several extruders are experimenting with thin vinyl film extrusion but the technique is far from perfected, largely due to the critical temperature of the compound. The prospect for extruding thin film is intriguing because it would lessen the high cost of installing calendering equipment and the accompanying compounding equipment. But calenders in the field are already capable of such tremendous production that extruded vinyl film would seem to be applicable, for the present at least, only to specialty applications requiring thicknesses of less than 4 mils. Thicker sheeting is being extruded on a small scale today for floor tile and in Brazil and Europe for upholstery.

Vinyl monofilaments are being extruded by several companies for use in various types of brushes with considerable success, but it is a highly technical process requiring special knowledge and compounds and will probably never be of a volume to compare with the better known vinyl uses. A correspondent from Brazil says that in his country vinyl filaments are being blended with polyethylene filaments for weaving into seat covers. He says the sag in one counteracts the shrink in the other.

It is estimated that about 5 million lb. of vinyl resin were used for molding last year in addition to the amount used for phonograph records. However, vinyl producers expect elastomeric molding to gain rapidly during the next year. It has already proved acceptable for vacuum cleaner bumpers and nozzles, luggage parts, handles for lawn mowers and bicycles, valves, pedal pads, etc. Almost the entire mechanical rubber goods field is open for vinyl competition and from injection molders too, since the rubber processors seldom work with injection presses.

Vinyl in phonograph records made a big increase in 1949. It is believed that 50% of all records being made now contain vinyl resin. They are not all high-fidelity records, of course, which are practically straight, rigid, unplasticized vinyl, but even the low-cost records now use a high percentage of vinyl resin and scrap from the high-fidelity records as a goodly portion of their mix. The demand for non-breaking characteristics which these resins impart is the reason.

More Floor Coverings

Vinyl floor coverings increased in volume, but slowly, during 1949. Present volume is insignificant compared to other vinyl uses, but the industry still expects that floor coverings will eventually use up great quantities of vinyl. Several new ones came out during the year, including two sandwich types. One of these has a felt base, a vinyl-coated paper middle layer with the design printed thereon and a layer of transparent vinyl paste over it. The other

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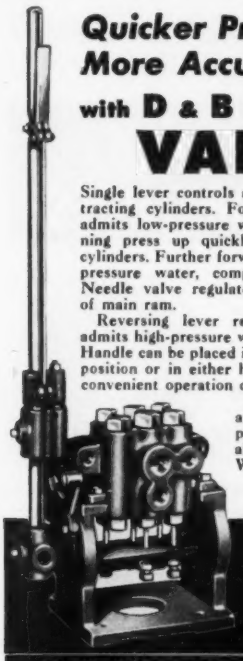

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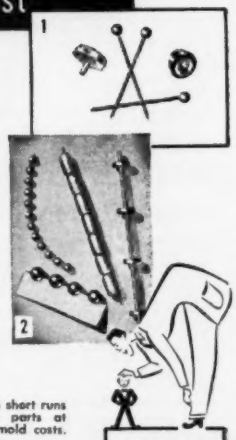

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is somewhat similar except that it has a vinyl-filled base. Another new floor covering is a vinyl and cork tile. Still another is an embossed solid vinyl sheet on fabric or sponge rubber, made to simulate carpeting.

One of the most important developments of 1949 was the free availability of plasticizers, particularly DOP (dioctyl phthalate), but the subject is too big to handle in this space. Whereas DOP could once be obtained from only two companies, there are now at least 10 in the field. Approximately 70 million lb. were sold in 1949 in comparison to about 48 million in 1948. Further development and expansion by a leading polymeric plasticizer producer and a new plant for an improved phosphate plasticizer contributed in a large measure toward betterment of the formerly troublesome plasticizer supply and quality angles. And it was also interesting to note that although sheet and film producers were plagued by what almost amounted to a price war, nearly all of them shopped around to get the best plasticizer available for the specific job at hand.

Polystyrene

(*Continued from page* 62)

Polystyrene wall tile is estimated to have used up from 3 to 4 million lb. of material in 1949. That's a big jump from 50,000 lb. in 1945 and would seem to quiet the early claims of critics that wall tile was a flash-in-the-pan business. However, there has been considerable shaking down in the industry. There are now less than 10 molders who concentrate on wall tile and only a few more who mold tile as a side line. In 1946 and '47 there were a score or more. Installation is no longer recommended as a job for an amateur. Several mastics are now available that don't show through. And a Commercial Standard is now being circulated for approval which, when adopted and adhered to by molders, should result in less trouble with FHA administrators.

A growing field with a potentiality of millions of pounds is agricultural uses such as caps employed to protect young seedlings. Molded berry boxes are now selling at 1¼ cents each which is reportedly lower than wooden boxes.

A feature of the polystyrene molding industry in 1949 was the ascendency of the Pacific Coast molders. It is only within the last year or two that Pacific Coast injection molders have cut much of a swath in the business, but they came up fast and handsomely in 1949. As one observer reports: "They had the audacity to try things that wouldn't work and then make them work. They had the nerve to try to mold a water pitcher which seemed like a poor possibility, and darned if they didn't come up with a good one." Said another observer: "Their answer to a suggestion was: 'How do you do it?' Not 'It can't be done.'" Housewares were their particular field, and they shipped them to the Mid-West and East for successful competition with local molders. They not only invaded the chain store purchasing offices in the East, but they found local distributors in Chicago, Kansas City, and other points. About 65% of their products are said to be mar-

(*Continued on page* 139)

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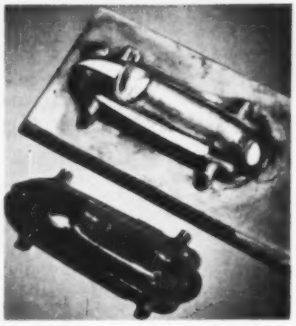

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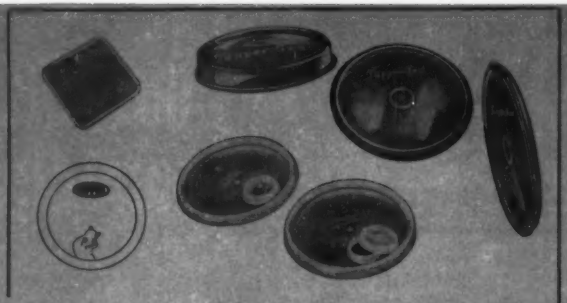

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keted east of the Rocky Mountains.

One of the reasons for the success of West Coast molders was their quick adaptation of pin point gating, a new technique by which the molder is sometimes able to obtain stronger pieces and cut finishing costs to a minimum. In some cases, bowl shapes for example, a better flow pattern is possible. There is less strain in the finished product and the orientation is round and round rather than up and down, thus giving greater strength to the finished product. Another example of pin point gating's merits is the experience of one molder who found that by using this technique he could use regular instead of high-impact polystyrene for breaker strips and still retain the needed strength.

Superior Material

Improved molding technique is only part of the story of the advances made in polystyrene. The molding material itself is far superior to that of former years; some of the material made as recently as 1948 wouldn't even flow in some of the large refrigerator parts made today. Without altering physical properties, producers have been able to formulate better compounds by employing improved compounding methods and adding new types of lubricants.

Higher heat resistance and greater clarity obtained by undisclosed methods have broadened the range of polystrene applications. Better coloring methods plus the addition of metallic shades have added to sales appeal.

Then there are the special formulations where physical properties are changed to give greater impact, higher heat resistance, more flexibility, etc., but their use has been surprisingly limited. Both molders and suppliers prefer one standard material, and research emphasis seems to be more on developing one general purpose material than a whole host of special purpose compounds.

In addition to higher cost, the special formulations are generally more difficult to mold. This is not to say that tailor-made formulations are out-the-window, for there will always be a certain demand for them to meet particular problems. Perhaps the larger molded pieces will require them, but the significant point is that such things as impact resistance, higher heat and light resistance, and faster molding cycles are properties being built into one standard grade material. One producer reports that over-all cycle time has been reduced as much as 30% in the last two years.

The use of polystyrene monofilaments for brush bristles also spread out in 1949 with the development of improved compounds that will deteriorate less rapidly on aging. This specially controlled material can not be injection molded. It will withstand temperatures of at least 192° F. Cost is now about 75¢ per pound. It is applicable to such things as push brooms where large and small diameter bristles can be mixed to give the necessary strength and efficiency.

The potential volume for broom bristles to replace natural fiber and animal bristles is 2 or 3 million lb. a year. Experiments are being made with these same polystyrene mono-

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filaments coated with aluminum for use in screen cloth.

The idea for handling polystyrene-glass combinations is still in a development stage. The method is to treat glass mat with a polystyrene emulsion, dry, preheat, and press. The combination can be pressed in a cold mold with a 15-sec. cycle, but to obtain a high polish, a temperature of 275° F. is desirable. One producer claims that the finished product can be made at a 10% lower cost than polyester laminates. The material has been recommended for all sorts of contoured shapes.

How far polystyrene in all its ramifications may enter into the economic life of America is a subject far beyond any ordinary man's ability to accurately estimate, but it has certainly had an amazing growth in the four years of its commercial availability since the war. The depth and width of its expansion when its exploiters have a chance to concentrate on reaching out into new fields barely entered or not even touched is of such proportion that perhaps 10 years will be required to find the answer.

Cellulosics

(*Continued from page* 64)

in such fields as strippable coatings, automotive cable coatings, ink for alkali resistance, and as a hot melt for paper coating to which it brings a very superior printing surface. Phonograph records are currently the largest outlet for flake.

Cellulose propionate remained in not much more than pilot plant production in 1949, but the producer is planning to instigate larger scale production in 1950. So far, it has been used most widely for pens and telephone hand sets and bases.

Butyrate

Cellulose acetate butyrate continued to be the most widely used of the higher-cost cellulosics. Extruded ⅛-in. sheet moved more prominently into the field for spectacle and sunglass frames, toys, soap and other telescoping boxes, and similar applications where stability is a prime requirement. Irrigation tube syphons increased in use and the first installation of a butyrate pipe for oil wells was made in Kansas where a 3500-ft. length of tubing was sunk faster than has ever been done with metal, and gave the added advantages of light weight and corrosion resistance. The underground pipe put in by a utility company in California several years ago is still undergoing tests, with no decision yet as to whether the pipe should be all plastic or plastic-coated metal. Similar tests are underway in other states.

Handles for carpenters' tools now seem definitely on the way for permanent adoption in butyrate or ethyl cellulose, but it has taken 10 years to do the selling job required to prove that they belong there. Experiments are now on the way toward increasing use of butyrate in large housings—a development that has been held back in previous years for lack of big machines.

Cellulose acetate sheeting producers put through a great many significant changes last year, the effect of which is not going to be clear until 1950, but they all seem to feel that 1950 will see a substantial increase over 1949. Cast sheet

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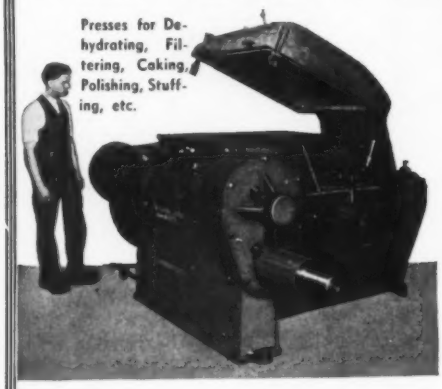

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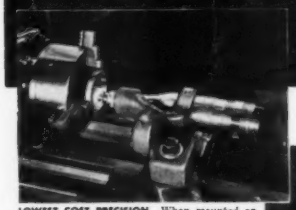

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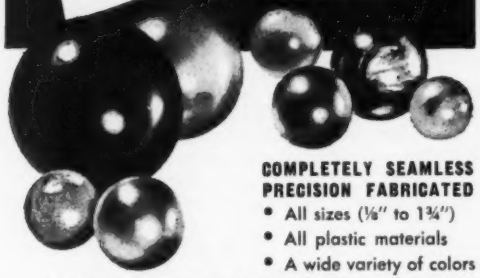

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122 East 42nd Street, New York 17, N. Y.

under 0.003 in. thick showed no increase over 1948 due to manufacturing adjustments, to the greater availability of cellophane, and to a general decline in the use of transparent film during early 1949.

One producer, at least, is planning to bring out a 1-mil extruded acetate film which will be low in cost and which, because of lower specific gravity, will compete pricewise with cellophane in many instances. It is, of course, headed primarily for packaging of fresh fruits and vegetables where acetate has already proved adaptable to some vegetables —tomatoes and spinach in particular.

Acetate sheet over 0.003 in. thick gained considerably in 1949 because a principal producer came out in March with a dry extruded sheet that sells for 30% less in unpolished and about 15% less in polished sheet than cast, block, or skived sheet.

In October another producer announced production of a new lower-priced line in this category in a new width of 60 in. designed to compete with dry extruded acetate. Optical properties of these lower-priced sheets are not equal to cast polished sheets, but there are scores of applications where they will be adequate for the job at hand.

Three cellulosic producers made significant moves during the year that scarcely need interpretation. Celanese Corp. of America announced that it was getting out of the nitrocellulose business and immediately pointed to such products as fountain pens, spectacle frames, shoe heel facings, and several other sheeting applications now frequently in nitrocellulose where it expects acetate to take over. Hercules Powder Co., one of the principal flake producers, quietly entered the acetate molding powder business on a comparatively small scale and immediately inaugurated an extensive educational campaign among molders, designers, and potential users on the merits of cellulosics and how they could be applied to many products that have not been using plastics in the past. Koppers Co. announced in December that it had ceased production of cellulose acetate and ethyl cellulose in the Berkeley Heights, N. J., plant which it acquired from Chemaco two years ago and will use that plant's facilities for coloring polystyrene.—END.

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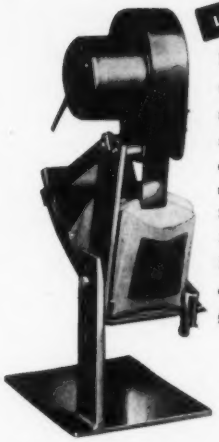

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Creep Tests

(*Continued from page* 100)

It is easy to show theoretically that the percentage stiffening effect of the gages should be inversely proportional to the stiffness of the specimen (cross-sectional area x modulus of elasticity). On this basis the stiffening effect for the thermosetting products (predicted from the 15% for the vinyl copolymer) should be 4 to 6% instead of the 11% observed. This theoretical relation brings out that the thinner the specimen the greater the stiffening effect. It is not proper to measure creep on plastic specimens much under 0.1 in. thick. Further, high sustained strains much exceeding 1% probably cannot be reliably measured.

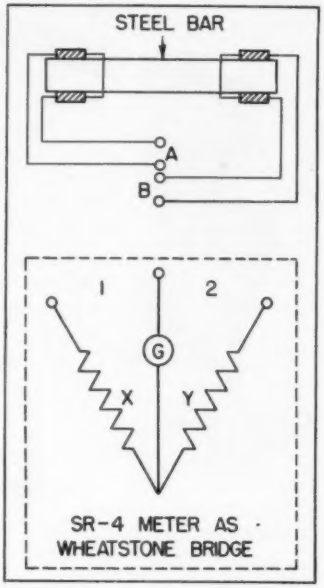
The constancy of the electrical circuit over a period of time may be estimated by a method suggested by Tschebotarioff (7). Two pairs of electric gages are affixed to opposite ends of a steel bar (Fig 18). A first reading is taken with the pairs connected in one way to the SR-4 meter (A→1, B→2) and a second with the pairs interchanged (A→2, B→1) by means of switches. The meter has been simplified to make the whole circuit a Wheatstone bridge. The same process is repeated daily. Typical readings are presented in Table III.

Now two kinds of changes occur from day to day in the circuit of Fig. 18. The first is in the circuits of A and B, whether in the leads or switches (gages assumed to remain constant); let it be designated (a). It appears always as the difference between the changes that have occurred in A and B. The second change takes place in other parts of the circuit, for example, in the fixed resistance (x); let it be designated (x). Then

$$\triangle_1 = a + x \qquad \text{"2"}$$
$$\triangle_2 = x - a \qquad \text{"3"}$$

where the deltas have the meanings in the tabulation.

Hence: $x = \frac{1}{2}(\triangle_1 + \triangle_2)$ and
$a = \frac{1}{2}(\triangle_1 - \triangle_2)$ "4"



18 — Method for measuring the variability of the electric circuit

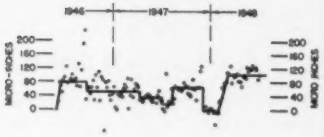
The changes (x) in the "permanent" part of the circuit for a period exceeding two years are shown in Fig. 19. Generally these fluctuations, expressed as strain in micro-in./in., are not large although no special precautions were taken. In the argument above no account was taken of changes that may occur in the switches when A and B are interchanged in the bridge circuit. Such variations in switching are part of the changes in the "permanent" portion of the circuit. Usually they are quite small (± 10 micro-in./in.,

Table III.—Tschebotarioff Method for Estimating Constancy of Electrical Circuit

	First Reading	Δ_1	*Second Reading*	Δ_2	$\frac{\Delta_1 - \Delta_2}{2}$	$\frac{\Delta_1 + \Delta_2}{2}$
Feb. 1	7-1120		0-940			
Feb. 2	7-1080	−40	0-980	+40	−40	0
Feb. 3	7-1070	−50	0-950	+10	−30	−20

as may be demonstrated by repeated switching).

The changes (a) may vary according to whether the changes in the individual circuits A and B happen



19—Variability of the permanent section of the electric circuit

to add or subtract. Over a period of two years, observations disclosed that they were usually ±50 micro-in./in.

No check was made of reliability at 75°C. In another paper (1) a steel bar, carrying the AB gage recommended for measurements at 75°C., was bent beyond the elastic limit and held that way for one month at 75°C. The reading on the SR-4 meter did not change in that time and the bond and circuit were concluded to be good.

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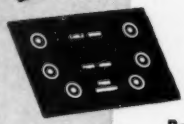

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NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Vinyl Plant Sold

THE vinyl resin plant at Painesville, Ohio, owned and operated by The Glenn L. Martin Co., has been sold to U. S. Rubber Co., and will be operated by the Naugatuck Chemical Div. of that company. The price paid was not divulged but has been estimated at near $7 million. The plant, annual capacity of which is rated at 25 million lb., consists of nine buildings, was built in 1947, and has been employing about 200 persons with a monthly payroll of $50,000.

The present management at Painesville will continue in charge there. The Baltimore operation, which included research and development, sales and technical service, and included about 65 employees, will be transferred to the Naugatuck Chemical plant, Naugatuck, Conn., some time in 1950. John P. Coe, vice president and general manager of the Naugatuck Chemical Division, which is located at Naugatuck, Conn., says that Harold M. Parsekian, who held a similar position at Martin, has been named manager of vinyl resin sales and will direct a national sales organization under George R. Vila, Naugatuck's general product manager for colloids, plastics, and agricultural chemicals. Clayton F. Ruebensaal and M. N. Hilseberg, both former Martin employees, will become part of the U. S. Rubber operation with the former becoming vinyl operations manager coordinating production and research. Mr. Hilseberg, who was manager of the Baltimore office, will direct credit and traffic and take charge of billing and invoicing. Robert H. Kittner, vice president of Martin, in charge of the Chemicals Division, has remained with Martin.

The Naugatuck Division now manufactures Kralac, a high styrene butadiene copolymer resin; Vibrin, a polyester resin; Koloc and Kandar, which are textile treating resins; and P2L, a resin for baked-on enamel. The Naugatuck Division is operated as a separate section as is the Footwear Division and the Mechanical Goods Division. The Footwear Division, with plants in Mishiwaka and Chicago, produces vinyl-coated fabric; patent vinyl sheeting; Royalite, a styrene copolymer buna-N compound used primarily as a sheeting material; and Satusply, a polyester laminate.

The Mechanical Goods Division, with plants at Fort Wayne, Ind., and Passaic, N. J., manufactures rubber and plastic materials for industrial use. The plastic products used are Enrup, a high styrene butadiene copolymer material for such things as bearings and automotive uses; Bartax, a similar material; Uscolite, a product manufactured from Kralac and other chemicals, which is used for cutting blocks and other similar uses.

Most of these products are based on high styrene copolymer materials where butadiene or acrylonitrile is the second monomer.

U. S. Rubber has always been a leading producer of coated fabric materials. The company got into the vinyl-coated fabric business early in the game with Naugahyde, a well known material. Like the three other members of the big four rubber group, it is now actually a producer of vinyl resin which it will undoubtedly use at least partially for its own coated fabrics and also produce resin for sale to customers. A spokesman for the company has said that it will continue to manufacture the same type of high molecular weight vinyl resin formerly produced by Martin which has been marketed as a material that could be either extruded, calendered, or made into rigid forms. However, he pointed out that Naugatuck has been doing research on vinyl for years and that it expects to apply the results of its experience and eventually broaden its scope so that it will be able to make specific types of vinyl resin for special uses such as wire coating, calendering, fabric coating and so forth.

*Reg. U.S. Pat. Office

S.P.E. Urges Quality Control

QUALITY control and its possible use in the plastics industry was discussed at a recent Chicago meeting of the Quality Control Sub-Committee of the Society of Plastics Engineers. It was suggested that the establishment and use of standards such as are used in the glass industry should be adopted by the plastics industry.

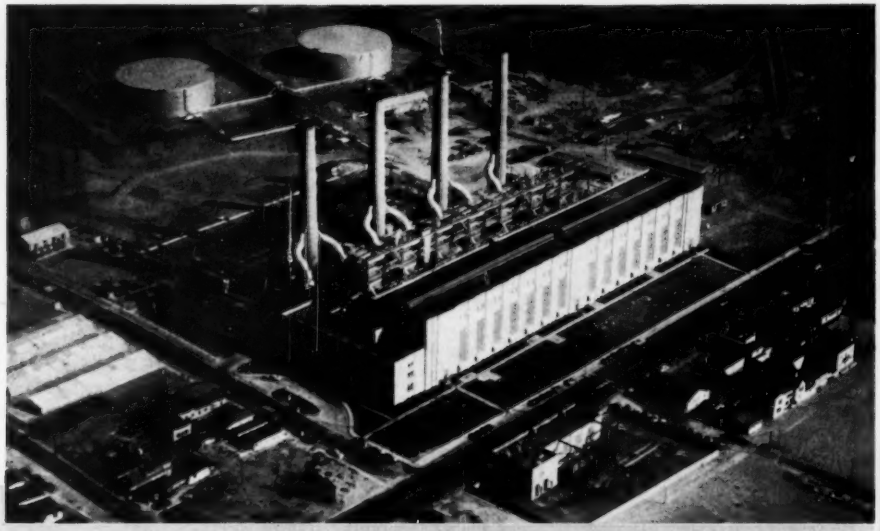
In order that individual problems can be assigned to two or more members at the same time, it was felt that the Quality Control Committee should be expanded to at least 25 members. Anyone, whether or not he is a member of S.P.E., who is interested in the work being undertaken by the committee and who has data that are needed by the committee is urged to contact Jerome Formo, Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave. S., Minneapolis, Minn.

Styrene for Floor Wax

NOW in production by American Resinous Chemicals Corp., 103 Foster St., Peabody, Mass., is a new styrene copolymer resin emulsion which, when added to floor wax, is said to impart improved anti-slip properties, lighten the color of liquid wax, increase its wearing qualities, and lower production costs. The material, called Arcco 1071-6C, is supplied as a 32% solids emulsion weighing 8.75 lb. per gal., and has a pH of 10 to 11. Shipments are made in carload, 10-drum, 1-drum, or less-than-drum lots. Samples or trial lots are available upon request.

Improved Copolymer

A NEW series of styrene copolymer molding powders, Plexene T, put on the market by Rohm & Haas Co. a few months ago, is beginning to cause considerable comment among molders and users. Some of the uses for which the new materials are now being tested include



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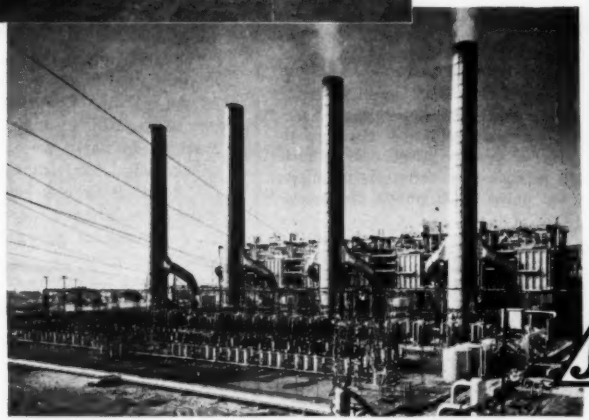

The 280,000 kw Redondo Steam Station was constructed to keep pace with the rapidly growing power demands of this region. Semi-outdoor design combines economy of construction with operating comfort and convenience and the entire structure has been built to resist the stress of possible earthquake shock. Unique is the provision for control of marine growth through thermal shock during periodic reversal of salt water flow in the two 2,000 foot intake and discharge tunnels which obtain condenser circulating water from the Pacific Ocean.

Stone & Webster Engineering Corporation designed and constructed the Redondo Steam Station for Southern California Edison Company.

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business machine housings, radio housings, cameras, and permanent type packages such as accessory tool boxes where the box is used for the life of its contents. Pen and pencil parts and high-quality toys molded from Plexene TA are now ready for marketing. Another unusual use is for water pipe, either for underground or in other applications. Arm rests for metal lawn furniture have been produced, with one example cited where the metal arm was bent but the plastic was unharmed after violent contact with a concrete floor.

Plexene TA is noted particularly for its high impact strength, which is similar to that of the cellulosics. The impact strength, ft. lbs. per in. of notch ½ x ½ in. notched bar, Izod test for nylon is .93; Styron 475, 1.00; cellulose acetate and celluose acetate butyrate, from 1.5 to 7.00; and Plexene TA, 5.00. The material sells for 54¢, but its specific gravity is low, 1.07.

Plexene TA offers a rare combination of properties for a thermoplastic in that it has extremely high impact strength coupled with excellent dimensional stability. It has very low water absorption, almost no after-shrink or swelling, and no plasticizers are involved in its make-up. The producer says that it has a considerably higher surface hardness than is generally found in cellulosics of comparable impact strength, and its gasoline resistance plus good aging properties make it a possibility for the automotive field. The producer likes to refer to the Plexene T series as having the impact strength of cellulosics and the stability of polystyrene.

A new modification called Plexene TC has been announced which has a higher modulus of elasticity and higher Rockwell Hardness with heat distortion point of about 193° F. in comparison to 183° F. for Plexene TA. Its impact strength is a little less than straight TA formulations, but both materials can have nails driven through them without being shattered.

German Plastics

A RECENT article in Britain's *Manchester Guardian* concerning Allied policy in rehabilitating German industry is significant to the plastics industry. Says the *Guardian*: "Although all Germany's synthetic oil and synthetic rubber plants are to be spared as a result of the Bonn agreement they will not be allowed to produce their synthetic products, the manufacture of which is still prohibited. They will have to turn, as they easily can, to the production of soap, plastics, and to processing natural oils and other products which are not of potential military use."

For Goodness Sake!

A RECENT issue of *The Sun*, New York, made the following startling announcement: "From England comes a new version of Polythene which is described as 'the lightest plastic known.'" Tsk! Tsk!

Polyester Catalyst

LAMINAC catalyst 347, which has previously been stocked at American Cyanamid's Bridgeville, Pa., plant for sale with Laminac resins, will hereafter be sold directly through the manufacturer, Lucidol Div., Novadel-Agene Corp., 1740 Military Road, Buffalo 5, N. Y. The material is designated by the manufacturer as Lupersol DDM.

Phenolic Plant Sold

THE phenolic resin plant at Forest Park, Ill., formerly operated by Interlake Chemical Corp., has been sold to Acme Resin Corp. which will have liquid resins available in February. These resins are particularly applicable for bonding, laminating, surfacing, impregnation, bonding mineral wool insulation, and for use as a core binder. President of the new Acme Resin Corp. is Myron T. Bennett, formerly vice president in charge of sales for Interlake Chemical. Edgar Bourke is vice president, Stephen A. Mitchell is secretary, and L. J. Hanna of the old Interlake plant continues as plant manager.

Anti-Static Materials

A NEW approach toward the removal of static charges on plastic materials is claimed by Merrill J. Ainsworth, engineering consultant, 17544 Raymer St., Northridge, Calif. Mr. Ainsworth emphasizes that his discovery should not be confused with conventional anti-static waxes,

Products That Use Plastics

The growth of the plastics industry is, to a considerable extent, dependent upon the number of finished items produced by other industries. The following table, showing production figures for some of the leading products requiring plastic materials, has been compiled from a tabulation set forth in the Jan. 3, 1950 issue of *The Wall Street Journal*. The 1949 figures were gathered from Government statistics and industry estimators; most of the others are published government census figures. The nylon figure is estimated by users; the producer has never made public the actual figure.

	1946	*1947*	*1948*	*1949*
Television cabinets	6,500	178,000	975,000	2,750,000
Vacuum cleaners	2,289,000	3,800,000	3,360,000	2,875,000
Washing machine	2,124,000	3,783,000	4,334,000	3,100,000
Dwelling units	671,000	849,000	931,000	1,000,000
Automobiles	2,160,000	3,560,000	3,900,000	5,110,000
Machine tools (dollars)	$325,000,000	$300,000,000	$285,000,000	$255,000,000
Trucks	124,000,000	145,000,000	166,000,000	175,000,000
Nylon (pounds)	20,000,000	30,000,000	48,000,000	70,000,000
Radio sets	14,000,000	20,000,000	16,000,000	10,000,000
Phonograph records	290,000,000	325,000,000	200,000,000	200,000,000

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solutions, and mechanical methods of seeking this relief.

The method, called the Electrosol process, consists of a quick dip or spray application of two successive formulations. Appearance is unaffected, and surface hardness, abrasion, and scratch characteristics are frequently improved, according to Mr. Ainsworth, who further states that the treatment has no deteriorating or damaging effect on any of the acrylates, methacrylates, cellulose acetates and nitrates, phenols, styrenes, vinyls, and resins in common use. Neither does it have any effect on any of the paints, enamels, or lacquers commonly used in connection with plastics.

Electrosol materials are non-volatile, non-explosive, and non-flammable. The total deposit on the parts or materials processed averages 0.00035 in. in thickness. Plans are for its licensing to qualified users.

Anti-static polyethylene — Being manufactured and sold by Chemical Development Corp., 857 Boylston St., Boston, Mass., is a colorless, odorless, non-flammable liquid which can be applied by dip or spray as an anti-static agent for polyethylene film, tubing, and moldings. Called Anstac-P, it is being used by some extruders and molders as a quench in place of water. Drying is accelerated if the polyethylene is immersed and removed while still warm.

Brazilian Plastics Trade

AN Association of the Plastics Industry of Brazil has recently been formed in Rio de Janeiro. This initial organization now consists largely of molders in the Rio de Janeiro area. The Brazilian plastics industry currently represents an investment of $11,000,000.

A representative of the Brazilian plastics industry says that one of the most important problems confronting them today lies in the restrictions (brought about by the country's economic situation) which the Banco de Brazil has been forced to impose upon the import of plastic materials from the United States.

Brazil has long been regarded by American materials and machinery manufacturers as a prime export market; however, the recent ban on import licenses and the backlog of payments of American credits by the Banco de Brazil has brought trade with Brazil to a virtual halt in recent months.

Modern Design

THE best examples of modern design in home furnishings will be presented by the Museum of Modern Art, New York, N. Y., and The Merchandise Mart, Chicago, Ill., in three showings annually. The first, called "Good Design," opened in The Merchandise Mart on Jan. 16. Additional selections will be shown in June during the Summer home furnishings market at The Mart, while in November each year a culminating design exhibition will open simultaneously in the Museum of Modern Art in New York and in The Merchandise Mart based on the year's earlier displays.

Director of the Chicago activities is Edgar Kaufmann, Jr., who has been associated with design activities of the Museum since 1940.

Projection Screens

TWO major projection-screen hazards—fire and mildew—are overcome in a new glass-beaded vinyl fabric announced by Radiant Screen Mfg. Corp., 2627 W. Roosevelt Rd., Chicago 8, Ill. The new beaded fabric, called Vyna-Flect, is recommended where public safety requires a flame-proof material and is claimed to be the first beaded fabric that can withstand tropical humidity. The screen fabric formerly used in projection screens was fine, closely woven muslin; however, the vinyl fabric eliminates the serious problem of mildew cutting through the adhesive.

The manufacture of the projection screen begins with the vinyl sheet, to which is applied coatings of white pigment on both front and back surfaces and blue pigment on the back surface only. Specially designed coating machines hold tolerances to 1/2000 inch. Both white and blue pigments contain a special plasticizer developed by Radiant chemists, which provides the flexibility demanded of the screens. On completion of the coating operation, a matte white fabric is obtained, a type still used for projection under certain conditions.

The glass beads used for Radiant screens are the smallest available on any screen surface, each bead measuring about 8/1000 in. in diameter. Radiant beads are also alkali-free, as it was found that alkali in beads produces rapid deterioration in the cloth. The adhesive used to bond the beads to the coated base of the screens is a clear thermoplastic. It forms a tenacious bond with the beads and becomes an integral part of the plastic used as the projection screen base.

Lubricant

RECOMMENDED for mold parting and for preventing plastic compounds from adhering to molds and dies is an "electronized" lubricant, Moldeze, perfected by Protective Coatings, Inc., Detroit, Mich.

The material is applied by mist spraying, and treatment is necessary only at extended intervals, according to the manufacturer. Moldeze does not cloud, mar, or "watermark" the finish of translucent or transparent plastics and contributes to producing smoother, more brilliant finishes to parts, according to the producer. It is claimed to act as a rust inhibitor, protecting dies and molds against rust during intermittent use or when stored over long periods of time. Standard packaging is in pint size bottles.

To Reclaim Metal Parts

PERMITTING easy manual application without the need of intricate machinery are two new metallurgical products announced by Western Sealant, Inc., 9042 Culver Blvd., Culver City, Cal.

One item, called Flawmaster, is a thermosetting compound used to reclaim metal parts and castings otherwise rejected because of surface flaws, sand pitting, foundry gas holes, or other imperfections. It is said to be machinable, chemically

"designed right—in the right plastic"

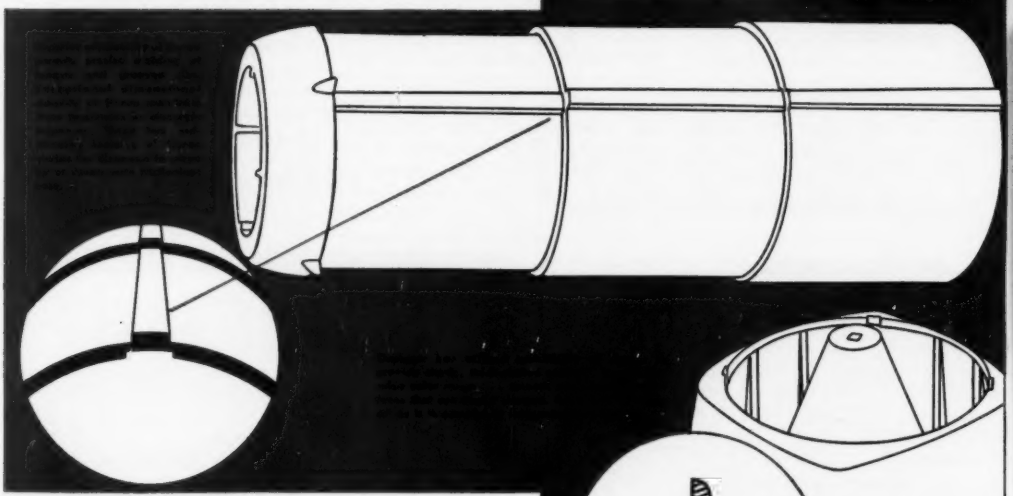
CUSTOM MOLDERS' KNOW-HOW plus

STYRON

solves another production problem!

ANOTHER CUSTOM MOLDING CASE HISTORY

Styron was utilized ingeniously by the custom molder in mass producing this Lily Cup Disponser. Telescopic disponser descends slowly into base as cups are removed from top. The choice of Styron for this disponser meant: lower material and finishing costs, faster assembly and more attractive appearance than any of the materials used previously.



Molded by MacDonald Manufacturing Company for Lily Tulip Corp., New York

The custom molder is skilled in solving difficult fabrication problems in plastics. To serve you, he maintains extensive design and engineering facilities, staffed by technicians with long experience in engineering plastics into finished products. These men have an intimate knowledge of the properties and the performances to be expected from Styron plastic formulations. Their judicious selection of the correct formulation means your product will be "designed right—in the right plastic".

The Dow Chemical Company works with custom molders to help you utilize Styron (Dow polystyrene) to the best advantage in your products. Write Dow today and let us put you in touch with qualified Custom Molders, who can solve your problem.

Plastics Division, Dept. SOT-8

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inert, and resistant to a wide range of temperatures.

The other material, called Bonding Agent R-313, is a medium for manually bonding dissimilar and similar materials—such as glass, plastics, neoprene, leather goods, and others—to metals; ferrous to non-ferrous metals; etc.

Standard for Plywood

MAJOR changes in glue types, maximum veneer thicknesses and test requirements, and minor changes in grades are incorporated in the new Hardwood Plywood Commercial Standard CS-35-49, which supersedes Commercial Standard CS-35-47. Complimentary copies of the new Commercial Standard are available from the Southern Plywood Manufacturers Assn., 728 W. Peachtree St., N.W., Atlanta, Ga.

Phenolic for Agitators

ESPECIALLY formulated for molding washing machine agitators or parts operating under similar conditions is a new phenolic molding compound, Durez 14899 Black, recently announced by Durez Plastics & Chemicals, Inc., 8 Walck Rd., No. Tonawanda, N. Y. It has been made to meet the long-standing demand of washing machine manufacturers for a material which will have good surface luster and finish after repeated immersion in hot soap and other detergent solutions. Twenty 4-hr. tests in boiling soap-water solutions show no effect on finish, according to the producer.

Durez 14899 Black has high impact strength, fast cure, and low moisture absorption. A similar material is also available in scarlet.

For Bonding Acetate

CLAIMED to be more efficient and less hazardous than acetone for bonding cellulose acetate objects is a liquid cement recently announced by Schwartz Chemical Co., Inc., 326 W. 70th St., New York 23, N. Y. Called Acetate Cement, the solvent mixture is said to be less volatile than acetone, does not require a Fire Dept. permit, and can be stored safely in unlimited quantities. It evaporates slowly enough to prevent blushing and to insure good penetration and an excellent bond, according to the manufacturer. Described as water-white, free-flowing, and non-toxic, the new acetate cement is available for immediate delivery in quart, 1-gal. and 5-gal. cans, and 55-gal. steel drums.

Diallylcyanamide

INTRODUCTION for the first time of trial lot quantities of diallylcyanamide has been announced by the New Products Dept., American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y. The new material is a liquid having a boiling point of 222° C. and a freezing point below —70° C. Less than 1% soluble in water at 28° C., diallylcyanamide is miscible with most organic solvents and acts as a solvent for most natural and synthetic resins.

In addition to diallylcyanamide, the dimethyl, diethyl, and diisopropyl cyanamides are also available in experimental quantities. A technical bulletin on these compounds is available upon request.

Improved Rubber-Phenolic

THREE new Hycar-phenolic molding compounds have been developed by the Chemical Dept., General Electric Co., Pittsfield, Mass. Supplementing the company's earlier wood flour-filled Hycar-phenolic compounds, the new compounds consist of an asbestos-filled, a cotton flock-filled, and a fabric-filled compound. Each of these compounds is said to be shock, vibration, and fatigue resistant.

The new powders are said to extend the range of impact resistance for thermosetting molding compounds, permitting their use in applications formerly considered impossible for plastics materials. Company tests indicate that parts molded from these compounds will withstand severe mechanical abuse, which reduces breakage in shipping, handling, and assembling.

COMPANY NOTES

The Dow Chemical Co. has opened a new sales office in Atlanta, Ga., to serve Georgia, North and South Carolina, Alabama, and Florida. **Leroy C. Stewart,** head of the Washington office, will have charge of the new office. The company has also appointed **A. R. Tucker, Jr.,** formerly of the Los Angeles office, to head Styrofoam sales at the company's home offices in Midland, Mich., where he replaces **Joseph E. Russell** who recently resigned. **E. R. Turnquist** will be technical sales advisor for Styrofoam.

Vanguard Corp., Chicopee, Mass., has appointed **Edward O. Clark, Jr.,** as sales manager. He has been president and general manager of **McLoughlin Bros.** and **Milton Bradley Co.** Vanguard has recently built a new plant in Chicopee and is now a major producer of inflatable and heat-sealed plastic products. Among their feats last season was the production of over ten million of Al Capp's Shmoos.

Reichhold Chemicals, Inc., Detroit, Mich., has formed a Canadian affiliate, **Reichhold Chemicals (Canada) Ltd.,** Toronto, and the latter company has purchased the **American Alkyd Industries,** Carlstadt, N. J., and the unfinished resin manufacturing plant of **Canadian Alkyd Industries Limited** at Weston, a Toronto suburb. This is the fourteenth plant in the Reichhold establishment.

Plax Corp. Div., Hartford-Empire Co., Hartford, Conn., has appointed **Northwestern Bottle Co.,** St. Louis, Mo., **Container Service Co.,** Los Angeles, Calif., and **H. Smith Bottle Supply Co.,** Atlanta, Ga. to handle distribution of Plaxpak squeezable polyethylene bottles. Plax now has seven distributors for its bottles which are furnished in standard Boston Round shapes.

Diamond Alkali Co. has announced a 15% price reduction of Chlorowax 70, a resinous chlorinated paraffin, bringing it to 15½ cents per

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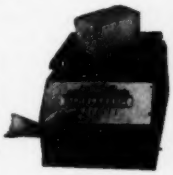

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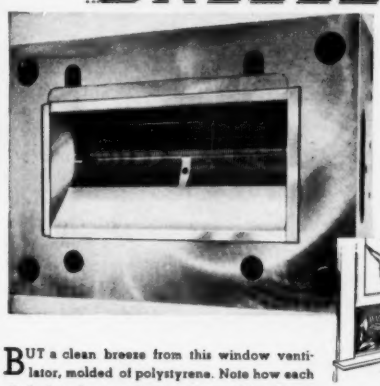

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2-piece interlocking ventilator adjustable to 36 inches.

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lb. l.c.l. and 15 cents per lb. carload. The material is used to impart flame resistance, adhesion, gloss, water resistance, and chemical resistance to textile coatings, paper coatings, adhesives, and floor coverings, and for flame-proofing of polyethylene and polystyrene, according to the producer.

Nixon Nitration Works, Nixon, N. J., has announced the election of **Morris Breitkopf** as president. Mr. Breitkopf has been associated with the company for 32 years and has served as secretary and treasurer until his recent promotion. **Stanhope Nixon** was re-elected chairman of the board of directors. Other officers elected were **Mark W. Peters, Lewis Nixon,** and **Richard Winter,** vice presidents, and **Charles Shuster,** secretary and treasurer.

Glyco Products Co., Inc., of Brooklyn, N. Y., and Natrium, W. Va., has moved its Chicago, Ill., offices to the Tribune Tower Bldg., 435 N. Michigan Ave., Chicago 22.

Die-Mold Corp., 6619 W. Motor Ave., Milwaukee 13, Wis., designer and builder of plastic molds, die-casting dies, and permanent molds, has appointed **Adolph D. Mandl,** formerly with Allied Chemical & Dye Corp. and General Aniline Film Corp., as manager of its plant. **Sig Mandl** continues as vice-president and general manager.

Kessler Chemical Co., State Rd. and Cottman Ave., Philadelphia 35, Pa., has announced the formation of its sales affiliate, **Kessco Chemicals Corp.,** to handle sales and distribution of its entire line of products, including fatty acid esters, emulsifiers, oils, waxes, etc. **Maurice J. O'Connor** has been appointed sales manager of the new firm. The new corporation has opened a mid-western sales office at 333 N. Michigan Ave., Chicago 1, Ill., with **Stanley F. Choate** in charge. It will continue to be represented in the New York area by **W. W. Angus, Inc.,** 220 Broadway, New York 7, N. Y., and in New England by **M. F. Robie and Sons,** P. O. Box 26, South Braintree 85, Mass.

Continental Screw Co., New Bedford, Mass., has announced that its sales representative, **Leonard A. Ashworth,** who formerly covered the New York metropolitan area, is now representing the company in Maine, New Hampshire, Vermont, and Connecticut. **Robert A. McCormick** has left the office staff to take over the New York metropolitan area, and **Paul R. Flemming** is covering the State of New York and a portion of Pennsylvania.

Modern Art Printing Co., whose plant at 21 W. 17th St., New York, N. Y., was completely destroyed by fire last October, has taken up new and larger quarters at 67-73 Kent St., Brooklyn, N. Y.

The company has just been granted a patent on its "apparatus and method of printing on polyethylene bottles" and is now specializing in this work. It also decorates other plastic materials in one or more colors by the Modern Art process of color engraving.

Acryvin Corp. of America, 18-12 Astoria Blvd., Astoria 2, L. I., N. Y., manufacturer of acrylic plastics, has announced perfection of a new process for casting simulated tortoise shell acrylic sheets, in which the colors are incorporated into and become an integral part of the sheeting. Conventional methods require the application of dyes as surface coatings on the base plastic to obtain a simulated tortoise shell effect, according to Acryvin.

The new plastic sheets are available in transparent, translucent, and opaque types, with the colors in each type being light, medium, and dark. The sheets are cast in thicknesses ranging from ⅛ to 1 in., in the conventional 3- by 4-ft. sheets.

Hercules Powder Co., announces that **Emmet E. Hixon** has been transferred from the New York sales office to Wilmington to promote cellulose acetate. He will be replaced by **Richard S. Clark. John B. Martin** has been assigned to the ethyl cellulose plastics promotion group.

The Todd Co., has acquired from Karge & Son Machinery Co., the patent rights to manufacture and distribute the precision lathe and screw machine attachment at the Todd plant in Rochester, N. Y. Designed especially for extremely slender turning of shafts and tubing, the Turnomat can work to tolerances down to tenths of a thousandth of an in., handle work of great length, and give a ground-like finish hitherto impossible without polishing or grinding, according to the manufacturer.

The Turnomat can be used for turning plastics, fiber, and rubber, as well as metals, and will fit many sizes and makes of lathes or screw machines.

The United States Testing Co., Inc., Hoboken, New Jersey, has merged with **Esselen Research Corp.,** Boston, Mass., and formed **Esselen Research Div., United States Testing Co., Inc.** Operations in Boston will continue under the direction of **Dr. Gustavus J. Esselen,** the founder.

Renwal Manufacturing Co., Inc. has moved to a new factory and general headquarters building in Toyland Park, Mineola, New York.

Continental Can Co., Inc., Cambridge, Ohio, has announced the following appointments: **Paul L. Hobbins** has been made sales engineer for custom molded parts in the Cleveland area, **Alfred Kuthe** will handle sales in the firm's Central Div. office at Chicago, and **Henry Kazimier** will handle sales in Indiana with headquarters at Edinburg, Ind. All three men will also handle preliminary inquiries for laminated sheets.

The Bilnor Corp. announces the removal of its offices and factory to 53-06 Grand Ave., Maspeth, L. I., N. Y.

Bakelite Corp. announces its consolidation with its parent corporation, **Union Carbide and Carbon Corp.** After Jan. 1, 1950, Bakelite Div., Union Carbide and Carbon Corp., will conduct the business formerly conducted by Bakelite

most plastics technicians

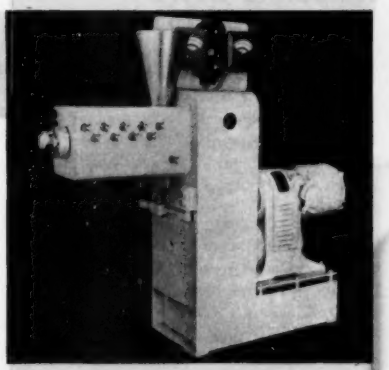
who know their business choose

mpm **EXTRUDERS**

You'll be following the lead of many of the country's foremost plastics extruders when you select MPM extrusion machines and auxiliary equipment. The experience of these organizations—and of others all over the world—has conclusively proven the high output, versatility and dependability of MPM equipment in making fine extruded products.

The superiority of MPM performance is no accident. It is a result of specific features (screw design, heat control, die head, etc.) which directly increase adaptability and production capacity.

Send for particulars and descriptive literature.



MPM 1½" Extruder This machine has been installed in scores of leading material suppliers' laboratories and in customers' plants. It handles a wide range of applications such as wire coating, blown film, rods, tubes, strips and the like. Materials extruded include Nylon, Kel-F, polystyrene, acetate, methacrylate, polyethylene, polyvinyl chloride and Formvar.

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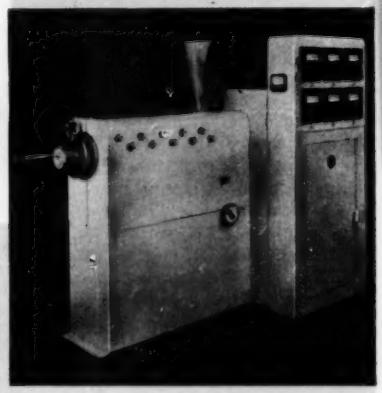
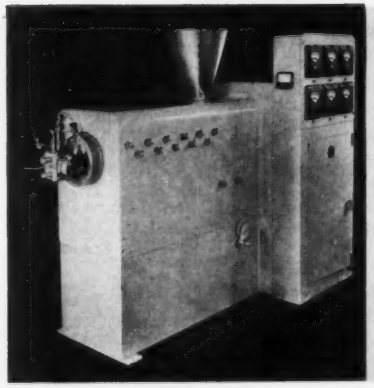


MPM 2½" Extruder The 2½" unit will extrude up to 125 pounds of polyvinyl chloride welting hourly, for example, and up to double the capacity of other machines with methacrylate. It can be furnished with a broad range of interchangeable heads and, like all other MPM extruders, it will extrude an extremely wide selection of materials.



MPM 3½" Extruder An extremely high - production machine, the new MPM 3½" Extruder excels in covering wire, compounding and coloring resins, and in producing heavy cross sections and wide films. As much as 150 to 250 pounds per hour can be produced, depending on the materials and the application.

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Corp. and will perform all existing contracts. There have been no changes in the organization.

PERSONAL NEWS

Miss Beulah Charlat has been retained to design and develop a new line of plastic film decorative ensembles for the **Pervel Corp.**, 475 Fifth Ave., New York, N. Y. Among Miss Charlat's present clients is the Shamokin Woolen Mills, for whom she is developing a woven plastic division.

George B. Harper has been appointed sales representative in the Detroit area for **Sobenite, Inc.,** South Bend, Ind., with his headquarters at 218 Lexington Bldg., 2970 W. Grand Blvd., Detroit 2, Mich.

Dr. Zay Jefferies, vice president of General Electric Co. in charge of the Chemical Dept., retired Dec. 31. Vice chairman of the War Metallurgy Committtee during the war, Dr. Jefferies has been a member of General Electric's four-man committee which administers the Nucleonics Project, consisting of all work on atomic energy being conducted by the company for the government.

Max Christensen has been appointed supervisor of plastics sales for the Chicago, Ill., territory of **The Dow Chemical Co.,** succeeding **Floyd J. Gunn,** who was recently named head of coatings sales with headquarters in Midland, Mich. Mr. Christensen joined Dow in 1945 and has served as coatings salesman in the Chicago territory since 1946.

George W. Wadtke has been named head of production and development of the **Plastics Div., Fabricon Products, Inc.,** River Rouge 18, Mich. He was formerly with **Briggs Mfg. Co.** in charge of the **Plastic Research Laboratory.**

A. G. Werner, 3650 Dover Pl., St. Louis, Mo., who has represented **Chicago Molded Products Corp.** in southern Illinois and eastern Missouri for 20 years, has severed his connection with them. He will continue operating on part time for other previously represented principals.

A. D. Cronk has been appointed advertising manager of **The Patent Button Co.,** Waterbury, Conn. He succeeds **Thayer Baldwin,** who has assumed increased duties as assistant general sales manager.

Douglas G. Eaton has been appointed manager of the Cleveland, Ohio, branch office of the **Reed-Prentice Corp.,** manufacturers of injection-molding machines.

Henry C. Carlson, formerly supervisor of the headquarters sales office for the **Chemical Div.** of **Koppers Co., Inc.,** Pittsburgh, Pa., has been named Midwest district sales manager for Koppers chemicals and plastics with offices in Chicago.

American Cyanamid Co., Calco Chemical Div., Bound Brook, N. J., announces that **H. E. Millson** has been appointed an assistant director of the Application Research Dept. in charge of the Dyes Technical Evaluation Section. **Dr. T. F. Cooke** is an assistant director of the same department in charge of the newly created Products Application Section which will study and formulate dyes, finishes, and pigments for new uses.

George B. Dryden, who founded the **Dryden Rubber Co.** in 1901 and later sold it to **Sheller Mfg. Corp.,** Portland, Ind., has retired as chairman of the executive committee of Sheller.

M. J. Daub, who has been secretary and sales manager of **Dura Plastics, Inc.,** New York, for seven years, has resigned from that organization. Mr. Daub has announced no plans for the future.

I. Milton Colbeth has been elected president of the **Baker Castor Oil Co.** He has been with Baker since 1920 and has served as chief chemist, chemical director and vice president in charge of operating division.

G. M. Wolf of **Sharples Chemical Co.** has been elected chairman of the Detroit Rubber & Plastics Group for 1950.

Leonard Maclean has resigned as sales manager of the **Plastics Div., Goodall Fabrics Inc.**

Deceased

Bernard W. Doyle, 76, who founded **Viscoloid Corp.,** Dec. 26, 1949. He was a former mayor of Leominster and founder of the Merchants' National Bank of that city.

MEETINGS

Feb. 13-14—Annual Meeting, S. P. I. (Canada), Royal York Hotel, Toronto.

Feb. 16—S. P. I. Boston-Providence Chapter, Panel Discussion on Sales, Hotel Beaconsfield, Boston, Mass.

Feb. 19-23—1950 Convention and Exposition of the National Association of Home Builders, Chicago, Ill.

Feb. 26-March 1—Regional meeting of the American Institute of Chemical Engineers, Swampscott, Mass.

Feb. 27-March 3—A. S. T. M. Committee Week and Spring Meeting, Hotel William Penn, Pittsburgh, Pa.

March 2-4—1950 Spring Conference, Pacific Coast Section, S.P.I., Hotel Del Coronado, San Diego, Cal.

March 16—S.P.I., Boston-Providence Chapter, "What the Purchasing Agent Looks for in Plastics," Hotel Beaconsfield, Boston, Mass.

March 28-31—National Plastics Exposition, Navy Pier, Chicago, Ill.

April 24-27—National Packaging Exposition, Navy Pier, Chicago, Ill.

S. P. E. Meetings

Feb. 13—Upper Midwest Section of S.P.E. at Coffman Memorial Union, University of Minnesota, Minneapolis, Minn. Sanford Glick of **Monsanto Chemical Co.** will speak on "Polystyrene—an Engineering Material."

Feb. 15—South Texas Section of S.P.E. in Houston. A representative of **Rohm & Haas Co.** will discuss "Plexene TA."

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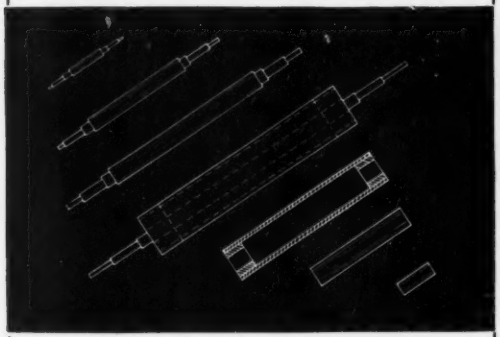

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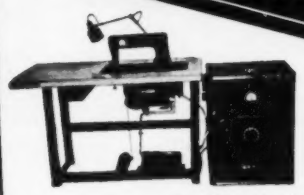

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Stearns Magnetic Drum, 24" Diameter x 18" Width. Complete with motor transformer and hopper. Reply Box X176, Modern Plastics.

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INJECTION MOLDING PRESSES
1—8 ounce Lester
1—6 ounce Lester
1—6 ounce Reed Prentice
1—2 ounce Reed Prentice

For complete details, reply Box X187, Modern Plastics.

INJECTION PRESSES: 2, 4, 6 & 8 oz. Reeds; 4 & 12 oz. HPM; 6 & 8 oz. Lester; 1 oz. vertical NRK. Extruders: 2½" NRM, 4½" oil heated Royle, 40' NRM Conveyor & Dryer. Ovens, Granulators, Tumbling barrels. Temperature Circulators. Apex rod. obj. printing mach. Preco Labpress. 1 as new Laminating Press 10 op. 30 x 30" Pl. 1—150 tons Stokes mod. 252 autom. clos. press. Pumps. 150 Tons self contd. Compress 24 x 24" Pl. Kux No. 50 single punch, Kux No. 25 rot. Preformpresses. Icecube Cup and Drawerpull used Inject. molds. Justin Zenner, 833 W. Sheridan Road, Chicago 13, Ill.

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FOR SALE: One each 8 oz. Reed Prentice, 16 oz. HPM, 2½" NRM extruder, 150 ton Stokes press, recent models, little used; several used toy and utility molds. We specialize in supplying foreign manufacturers of plastic products with all their requirements. Inquiries invited. Correspondence English, French, German or Spanish. Reply Box X199, Modern Plastics.

PRESSES:
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(*Continued on page 160*)

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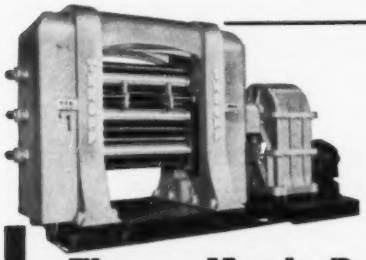

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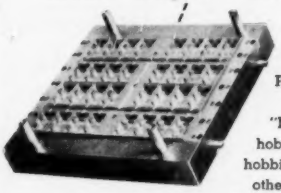

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(*Continued from page 158*)

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Cast Lucite Rod 1¾" Dia.
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MANUFACTURERS REPRESENTATIVES WANTED: Midwestern molder featuring ultra-modern molding equipment for thermosetting materials desires additional sales representatives; commission basis; specialty housewares handles and hardware, etc. Reply Box X192, Modern Plastics.

REPRESENTATIVE WANTED. Several territories are open to experienced representative in custom plastics sales for molder equipped to do compression-transfer and injection molding. Please state experience and territory in which you are now operating. Reply Box X169, Modern Plastics.

RESIN MANUFACTURER wants Representatives: experienced in sales UREA Resins —liquid and powder, for furniture, plywood and paper trade, etc. Will make permanent commission or salary arrangement, or both, as desired. New England and Middle West territories open. Confidential. Our men know about this advertisment. Reply Box X193, Modern Plastics.

WANTED: Manufacturers Representative for the sale of extruded thermoplastic products as well as custom Compression moulding. Reputable organization in business over ten years. Territories open in all sections with exception of Midwest. Reply Box X184, Modern Plastics.

PLASTIC ENGINEER with knowledge of extrusion, die making, compounding and coloring to take charge and help build up newly formed plastics department with well established firm. Must be able to do color matching for samples. An opportunity with a future for a man with ability and initiative. Write stating age, experience and salary expected. Reply Box X171, Modern Plastics.

MANUFACTURERS REPRESENTATIVE WANTED: Pioneer in structural adhesive, structural laminates and sandwich material needs representation in following areas: Chicago, New England, Ohio, and St. Louis-Kansas City. Materials have Air Force approval . . . Excellent research laboratory assured keeping up with the parade . . . The right man must be able to get in to engineers and top executives. Reply Box X166, Modern Plastics.

PLASTICS ENGINEER thoroughly experienced in the processing and manufacture of cellulose acetate sheet, permanent or temporary position with important plastic manufacturer in Rio de Janeiro, Brazil; able to speak German, Portugese, or Spanish. Write, giving full detail of experiences, languages, and salary expected, to
F. F. Neuman Company
59 Pearl Street
New York 4, New York

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EXPERIENCED PRODUCTION man available. 15 years experience in injection molding of thermosetting and thermoplastic materials. Past 11 years as plant superintendent. Tool and Die design a specialty, will locate anywhere. Reply Box X177, Modern Plastics.

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MOLDMAKER, 15 years experience: molds, special tools and dies, mold set-up and press maintenance. Prefer small business with opportunity to advance. Will relocate anywhere. Reply Box X180, Modern Plastics.

CHEMICAL ENGINEER SPECIALIZED IN PLASTICS, extensive industrial experience, will leave for Germany and other European countries in February for one year to study European developments in plastics industries. Write concerning commissions to Box X174, Modern Plastics.

LAMINATION, EXTRUSION AND COATING. Plastics and synthetic rubbers. Research and development. Technical director. Half days only. New York City area. Ph. D. in chemical engineering. Reply Box X198, Modern Plastics.

POSITION SOUGHT by Plastics Engineer, graduate I. M. E. with 13 years experience in all phases of molding; product design, mold design, tool making, production, plant design, maintenance, sales, and management. Married, 2 children. Locate anywhere U. S. A. or S. A. Reply Box X200, Modern Plastics.

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WANTED: Proprietory Items and Molds. Plastic manufacturer of consumer products seeks ideas for new products, also new and used molds of items with sales potential in any field. Liberal prices paid. Address Ben-Hur Products, Inc., 302 Fifth Ave., New York, New York.

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VINYL PLANT REPRESENTATION WANTED: Organization with office and capable technical salesmen wishes to connect with a concern making films from .003" to .022" gauge.
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95 Madison Avenue
New York 16, N. Y.

FOR SALE: Established injection molding firm of excellent reputation, comprising seven machines, completely equipped, splendid plant, ideal location for servicing east and midwest. Principals only. Reply Box X178, Modern Plastics.

PLANT FOR SALE: consisting of Modern Equipment in three units for Paper Pulp Preforming Plastic Wood—Cold Molding and Fabric laminated to Buckram Molding. Will sell complete or a separate department. Reply Box X167, Modern Plastics.

SCULPTOR DESIGNER and model-maker, having diversified background conceiving and creating originals for the plastics industry. Experience includes responsible positions in leading plastics toy and novelty companies. Specialist in animal and figure work, animated characterization, or realistic. Part-time, free-lance. Maurice Winters, 66 Jane Street, New York City 14. Tel. ORegon 5-2353.

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WILL PURCHASE children's or adults' used hanger molds. Also display box molds, suitable for rings, watches, etc. Reply Box X194, Modern Plastics.

DESIROUS OF COMMUNICATING WITH MANUFACTURER HAVING MOULDS TO PRODUCE SHAVING BRUSH HANDLES. REPLY BOX X197, MODERN PLASTICS.

SELL US YOUR PLASTIC or related manufacturing enterprise in whole or in part. Land, buildings and/or equipment. Reply Box X196, Modern Plastics.

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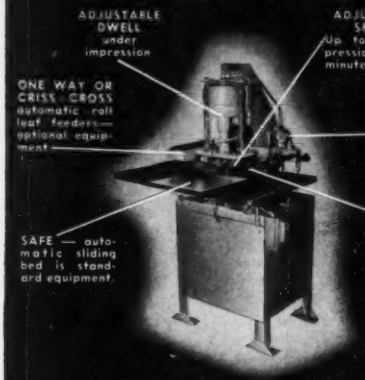
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SELF-COMPENSATING for variations in thickness.

Because it operates by compressed air power, it delivers a cushioned impression that eliminates breakage of the items being stamped.

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Sole Distributors: HAMBRO MACHINERY DIVISION

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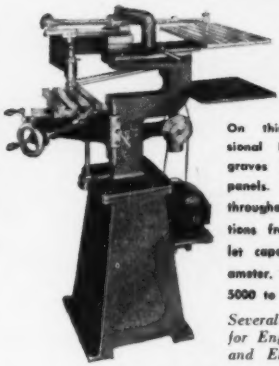
MODERN PLASTICS

122 EAST 42nd STREET • NEW YORK 17, N. Y.

New PANTO-ENGRAVER MODEL 2D-4



ENGRAVE
LARGE PANELS
NAME PLATES
STEEL STAMPS
STEEL DIES
AND OTHER ITEMS

On this precision two-Dimensional Engraving Machine. Engraves to center of 30" wide panels. Precision Ball Bearings throughout. Pantograph Reductions from 1:1 to Infinity. Collet capacity 1/10" to ¼" Diameter. Six spindle speeds from 5000 to 14000 R.P.M.

Several other models available for Engraving, Acid Etching and Electrical Marking.

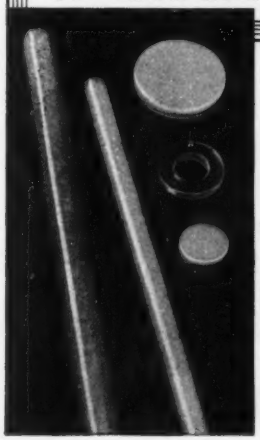
WRITE FOR ILLUSTRATED LITERATURE TODAY

H. P. PREIS ENGRAVING MACHINE COMPANY

653 ROUTE 29 HILLSIDE 5, N. J.

MARKING PANTO EQUIPMENT

NYLON . . MOLDED TO YOUR REQUIREMENTS



VALVE SEAT DISCS
in FM-10001 (Rigid) Nylon

VALVE WASHERS
in FE-1044 (Semi-Rigid) Nylon

CONTRACT NYLON MOLDING
We have the set-up and the experience to give you the best in nylon parts molding in small or large quantities.

SEND FOR QUOTATIONS ON SPECIFIC REQUIREMENTS

NYLON RODS
FOR IMMEDIATE DELIVERY
in ¼", ⅜" and ½" diameters and 8¾" lengths in FM-10001 Nylon. Quantity prices on request.

S.S.WHITE PLASTICS DIVISION
THE S. S. WHITE DENTAL MFG. CO. — DEPT. M — 10 EAST 40th ST., NEW YORK 16, N. Y.
FLEXIBLE SHAFTS AND ACCESSORIES
MOLDED PLASTICS PRODUCTS—MOLDED RESISTORS

ATLAS FADE-OMETERS AND WEATHER-OMETERS

. . . playing an important part in improving the quality of PLASTIC PRODUCTS . . .

The destructive effects of sunlight on plastic products such as hardening, loss of flexibility, cracking, change in color, etc., can be determined with speed and accuracy in the Atlas Fade-Ometer.

In making tests, samples are rotated in holders around the Atlas Enclosed Violet Arc—the closest approach to natural sunlight—with temperature and humidity regulated according to requirements of test. Holders are available for three sizes of samples, 2½" x 4¾" capacity 42 samples, 2½" x 8" capacity 21 samples, 6¼" x 10" capacity 9 samples. Tests can be duplicated at any time thus providing reliable data in product development work.

Operation is completely automatic and the Fade-Ometer can safely be left running continuously for 24 hours without attention. A few hours or days testing in the Fade-Ometer equals months or years of exposure to actual sunlight.

Fade-Ometer tests are fast becoming accepted as a yard-stick for standardization in the plastic field as they have been in the textile, paint and other industrial fields for over twenty-five years.

The Atlas Twin Arc Weather-Ometer is used to duplicate the combined weathering effect of sunlight, rain, heavy dew, and thermal shock for plastic products exposed to outdoor use. Like the Fade-Ometer it is completely automatic in all operations. The cycle timer can be set for duplicate tests at any time.

Write for further information in relation to your problem for testing plastic materials.

ATLAS ELECTRIC DEVICES CO.
361 W. Superior St., Chicago 10, Illinois

A plastic approach to a golden sales opportunity

Prospecting for increased sales of your product? Manufacturers all over the nation have discovered that, plastically speaking, we have the ability to turn sales idlers into sales go-getters. It's no secret how we do it. As the largest custom injection moulders in the East, with extensive facilities and experienced personnel, we are equipped to give your product a WMP beauty treatment, regardless of its size or shape.

If your problem concerns the revamping of an old product or the plastically designing and moulding of a new one, give us the opportunity to provide you with the plastic answer. We can guarantee a volume to dovetail with that of your own.

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Custom Injection Moulding

WORCESTER MOULDED PLASTICS CO.

14 HYGEIA STREET, WORCESTER 8, MASS.

17 East 42nd St., New York 17, N. Y.

THIRD OF A SERIES

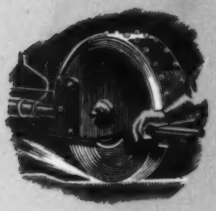
Know Your Plastics

IT MAY MEAN BETTER AND FASTER PRODUCTION... AT LOWER COST!

When you investigate plastics for your new or redesigned product, think first of BAKELITE Plastics and Resins. The BAKELITE family of plastics includes those in greatest demand. This gives you a wide selection, all from one supplier. The chances are that you will find the one plastic or resin that is best suited to your production facilities, and also the plastic that gives best qualities to your finished products at the lowest possible cost.

This message deals with "BAKELITE" BONDING RESINS

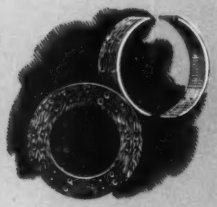
1. BONDING RESINS FOR ABRASIVE WHEELS



BAKELITE Phenolic Resins bond the abrasive particles of today's high-speed, heavy-duty grinding and snagging wheels operating at 9,000 surface feet per minute and cut-off wheels that operate at up to 16,000. These wheels are cool-running, non-gumming. The resin holds the particles until they're worn out, then releases them, exposing new particles to surface.

Typical uses: Grinding steel billets and castings; cutting off rod- and bar-stock; finishing alloy steels.

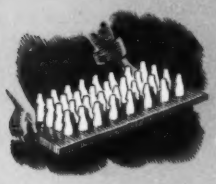
2. BONDING RESINS FOR FRICTION MATERIALS



Frictional elements such as brake linings and clutch facings are made much more resistant to wear, heat, and oil, when processed with BAKELITE Phenolic Resins. For example, they have virtually doubled the life of brake linings on many New York City taxicabs under the most strenuous driving conditions.

Typical uses: Brake linings and clutch facings for motor vehicles, railway cars, and power-driven equipment.

3. BONDING RESINS FOR SAND CORES



BAKELITE Phenolic and Urea Resins, both liquid and powder, are used as sand core binders for ferrous and non-ferrous castings. They permit faster core baking cycles, smoother surface finish of castings. They also provide improved collapsibility of cores. They can be baked in either standard ovens or high-frequency dielectric heaters.

Typical uses: Sand core bonds for ferrous and non-ferrous metals.

4. RESINS FOR ABRASIVE BELTS AND DISKS

"Coated" abrasive belts, disks, and sandpaper—with abrasive anchored to backing by BAKELITE Phenolic Resins—last up to five to six times longer in high-speed precision grinding. High resistance to heat and moisture permits either dry-grinding of metals, or wet-grinding of low-fusion-point materials.

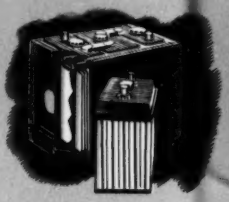
Typical uses: Many grinding jobs once done only by milling machines, profilers, shapers, even planers.

5. BONDING RESINS FOR THERMAL INSULATION

BAKELITE Phenolic Resins are widely used to bond glass wool, mineral wool, and vegetable fibers for thermal-insulation batts that possess high mechanical strength and stability even under conditions of excessive humidity and elevated temperatures.

Typical uses: Insulation for homes, refrigerators, and automotive equipment.

6. BONDING RESINS FOR FIBROUS MATERIALS



BAKELITE Polystyrene Resin emulsions form highly efficient bonds for many organic and inorganic fibers. They provide highly acid-resistant bonds for spun-glass mats that separate storage battery plates. They're excellent binders for carpet backing, preventing raveling, improving "hand," maintaining dimensions, and withstanding shampoos.

Typical uses: Storage battery mats, rug and carpet backing, paper and cloth.

7. TECHNICAL GENERAL PURPOSE CEMENTS

These BAKELITE Phenolic Cements are supplied in both baking and air-drying types, and in powder, paste, and liquid forms. They offer good resistance to heat and many chemicals, depending upon formulation and processing.

Typical uses: Joining dissimilar materials such as plastics, rubber, cork, wood, glass, ceramics, paper, asbestos board, and metals.

These are seven major industrial uses for BAKELITE Bonding Resins, which contribute so much to the economy of nearly every industry. The resins are produced in such variety and with so many useful properties that their new applications are endless. Bakelite Corporation has worked for nearly 40 years to increase their usefulness—gaining experience and knowledge that we would be glad to bring to bear on your problems. Your inquiries will be treated in confidence. For detailed technical data on BAKELITE Bonding Resins—or if you wish a Bakelite representative to call—write Department O-13.

Bakelite
TRADE-MARK
BONDING RESINS

BAKELITE DIVISION
UCC

BAKELITE DIVISION, *Union Carbide and Carbon Corporation*, 30 East 42nd Street, New York 17, N. Y.

MOLDED IN PLASTICS BY GENERAL ELECTRIC

LARGE VOLUME JOBS! G. E. is ideally equipped to mold large-quantity jobs—like parts for the Ocean City Manufacturing Company's surf-casting reel.

LOW SELLING PRICE! The use of G-E plastics (instead of wood) for this television cabinet helps to make possible a low-priced set.

PLASTICS FOR SALES APPEAL! This attractive cosmetic holder was molded by General Electric for Coty, Inc.

Plastics

How G-E Plastics Can Help You MAKE A PRODUCT THAT SELLS!

Interested in making your product easier to sell? Here's a case that illustrates how G-E plastics can add sales appeal to merchandise.

In 1946, General Electric molded the major parts for the first Beacon camera, made by Whitehouse Products, Inc., Brooklyn, N. Y. Over a quarter million of these cameras have been sold. Now, when Whitehouse needs parts for its new Beacon *two-twenty-five*, General Electric is once again the molder.

Larger than the previous model, the new Beacon *two-twenty-five* presented some interesting technical problems which G-E engineers solved to the full satisfaction of the customer. Like the first Beacon, it is molded in attractive phenolic plastics. Smart-looking, compact, lightweight, it is designed for volume sales.

One of the world's largest plastics molders, G. E. is ideally equipped for *large-volume* production. WRITE US FOR MORE INFORMATION on how this service can work for *you*. Or contact your nearest G-E sales office. Address: Plastics Division, Chemical Department, General Electric Company, 1 Plastics Avenue, Pittsfield, Massachusetts.

GENERAL ELECTRIC

CD50-D1

General Electric plastics factories are located in Coshocton, Ohio; Decatur, Ill.; Taunton and Pittsfield, Mass.